Become a better scale pilot—master the tail-dragger

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GP-07

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AirAGE

EDITORIAL
BY DEBRA SHARP

Toledo 2000

The aisles at the Toledo RC Expo were filled with modelers who came from across the country to check out the latest RC gear and products; they weren't disappointed!

For nearly half a century, the Toledo RC Expo has been the highlight of the RC airplane event calendar. Hosted by the Weak Signals R/C Club, this is the "grandaddy" of model airplane shows. Toledo is the place where leading manufacturers and thousands of modelers from across the country can meet to showcase and see new products, catch up on industry news and take stock of the latest developments in the hobby. By the end of the weekend, it was clear that the excitement and enthusiasic buzz at Toledo 2000 was extraordinary. At times, modelers stood shoulder to shoulder in the aisles, waiting to see the latest products firsthand, and at every turn, you could hear spectators talking excitedly about the latest RC treasure that they had discovered.

Throughout the weekend, everyone commented that "This is the best Toledo in years!" Several of the exhibitors we spoke to experienced record sales and had to send for additional products via express mail; it's doubtful that a single spectator went home empty-handed. The sheer variety of models and gear was astounding: products included everything from the Jet Hangar Hobbies' ARF ducted-fan BAe Hawk to a tiny, AAA-battery-size geared motor from AstroFlight to a 97-inch-span ARF Extra 330L from Hangar 9.

Although the ARF trend continued as companies unveiled even more giant-scale aerobats and sport and park flyers, there were plenty of new balsa and ply kits to choose from as well. The RC airplane hobby is growing in many directions, and it seems as though "traditional" RC niches, such as jets, giant-scale and micro flyers, are slowly becoming mainstream parts of the hobby and are beginning to be enjoyed by everyone. For instance, modelers who marveled at Lanier's new, 40-percent Staudacher seemed to be equally impressed by the new, twin electric park flyer from Northeast Sailplane Products. For more details on the products that were unveiled at the 46th annual Toledo RC Expo, check out Chris Chianelli's special five-page "Air Scoop" starting on page 14.

One of the more impressive models on display in Toledo was Jim Weigle's ⅒-scale, 21-foot-long Concorde. With an 8-foot wingspan, the 225-pound jet is powered by four AMT Olympus AT 450 turbines—each of which produces nearly 50 pounds of thrust! Jim designed the jet using a scale plastic model, then had fiberglass molds made to spec. With only the radio equipment and some hardware to install, the jet should be ready to fly soon; we'll keep you posted.

Jim Weigle's Concorde dwarfed the other jets on display. The 21-foot-long model won the Best Jet award.

MODEL Airplane NEWS
FOUNDED 1929

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ON THE COVER: main image—contributor Rick Bell relives the dawn of military aviation with his Balsa USA Fokker E.III Eindecker (photo by Walter Sidas); insets—Thunder Tiger's new GP-07—small, lightweight, powerful and good-looking, too!; and the Phantom Flightline, a group of BVM F-4s, caught by Rich Uravitch at Florida Jets 2000.

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AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

DUCTED-FAN JET FAN

George Leu's article on jets was a welcome sight! As one who returned to aircraft modeling two years ago (after a 20-year hiatus), I was astounded to discover that the little ½A-size Berkeley ducted-fan jets (really just noisy gliders, not effectively propelled models) of the late '50s and early '60s had grown up!

I did note one piece of misinformation, however. The new K&B ducted-fan engine is not a .48, as is widely thought, but a .45. The model number is 4825, and the crankcase does have much in common with K&B's new .48 sport engine, but with a bore of .850 inch and a stroke of .800 inch, it displaces just over .45ci, not .48ci.

Also, with the exception of those from O.S. and K&B, ducted-fan engines can be frustrating for beginners to find. It should be pointed out that the Rossi .53 shown in the article can be found at Czechmate Distributing, the MVVS folks (www.mvvs.com). Rossi's former distributor, Sig, now handles Irvine, which also offers a .46 ducted-fan engine that has very small external dimensions. Dubb Jett (www.jettengineering.com) has two fan engines available as well.

George could also inform prospective jet jocks of "The List" for jet modelers. Hosted by Bob Parks, this is an electronic forum for beginners and experienced jet fliers and builders. Email rc-jets-on@lists.kidsource.com, type "subscribe" in the subject header, and you're in!

Again, thanks for a fine article!

GEOFF SANDERS
Portland, OR

ANTENNA QUESTION

The article, "How to Custom-Fit your Cowl" in the March 2000 issue couldn't have come at a better time. I'm building a Lanier Stinger .60 and have been dreading figuring out how to cut the holes in the cowl. When I read the article, it made my day; now I can't wait to get to that part of the assembly.

One question: I've noticed in most of the photos you use that the antennae rarely hang out of the planes. I've only been back in the hobby for a few years, and it has been awhile since I've done any building; is it safe to keep the antenna inside the fuselage? Thanks for your help.

CRAIG BUCKLIN
Oxnard, CA

Craig, thanks for the kind words. To answer your question on antenna placement: in most cases, mounting your antenna within the fuselage is fine, if you keep it away from any servo and battery leads. This can be difficult to do if you have servos in the tail, and you run long extension leads back to them; the antenna can pick up electrical interference from these leads and shorten your range and/or cause erratic servo action.

Also, if you use the new Ultracote Supreme covering material (with aluminum pigment backing), you should not install an internal antenna, as the aluminum will effectively shield the antenna and cause a much-reduced radio range. Whichever way you install your antenna lead, do a static range check with the engine running to be certain of your radio's operation. GY

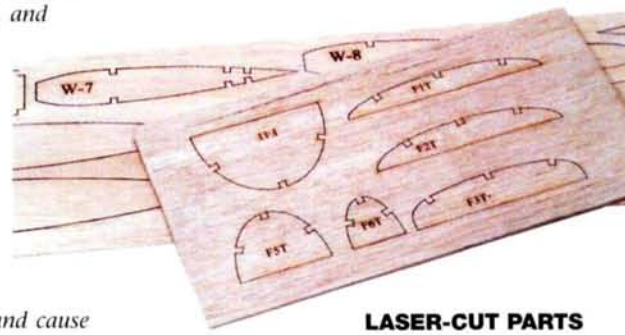
SMELLY STUFF

I enjoyed John Tanzer's article in the May 2000 issue on the use of nitrate dope to attach light fiberglass cloth. Nitrate adheres better than butyrate and is a logical choice. After many decades of modeling, however, I found the odor of these products to be objectionable. There are now water-based, polyurethane products on the market that do a good job of making lightweight fiberglass, silk, Polyspan, etc., stick to balsa. I have also tried a water-based acrylic, but it didn't have as strong a grip as the polyurethane in my test. Either of these will do fine as a substitute for "dope" in filling Polyspan, etc., on open structures. Shrinkage does not seem to be a problem. For those who need to avoid the odor of dope to get along with spouses, neighbors, etc., it's worth a try!

A friend of mine who was a traveling salesman used to carry modeling materials with him on trips and use them at night wherever he was staying. One night, there was a knock on the door; the local police had been called to arrest the "dope fiend" who had been reported to the manager by concerned neighbors. Seems the smell had been carried by the ventilation system to all the rooms in the motel!

BILL BAKER
Norman, OK

Bill, thanks for the information and the amusing story. Yes; the new water-based paint and finishing products available at hardware and home improvement stores are welcome additions to the modeler's workbench. I have also tried Minwax's polyacrylic floor finish to attach fiberglass cloth to balsa; it's an excellent substitute for smelly polyester resin. Besides being almost odor-free, nearly all of these water-based finishing agents are better for our environment than the paints and thinners we've traditionally used. I guess you could call it a win/win situation. GY



LASER-CUT PARTS

I've heard a lot about the new laser-cutting technology, and until now, I thought it was just for kit manufacturers. A friend told me that the price of laser-cutting has dropped to a level where almost anyone can get parts cut for any plan he might want to build from. Is this true? What's involved? Any help would be appreciated.

SGT. GEORGE UNGER
Lackland AFB, TX

George, it is true that laser-cutting of wood parts is now more affordable. Several companies offer this service, and some even supply the wood. To get parts cut, however, takes a little effort. You can't simply send paper plans to a company and have them cut the part for you. All laser cutters are computer-controlled, so the plans must be scanned into the CAD format and exported into a drawing transfer format (DXF). This file is then sent either on a PC disc or via email to the laser-cutting company. In almost all cases, to produce acceptable results, the scanned drawings must be "cleaned up."

If you know someone with a large-format scanner and the ability to format CAD files, then it is indeed possible to get laser parts from paper plans. But, remember, the parts will be only as good as the plans. If the parts are misdrawn on the plans, the laser-cut parts won't fit.

Companies that offer laser-cutting are Sig Mfg. (515) 623-5154; FX Models (860) 589-5279; and Arizona Model Aircrafters (408) 348-3733. Call them and ask for their requirements and pricing. Good luck. GY

AIR SCOOP

BY CHRIS CHIANELLI

This year's Toledo show may have been the best I've ever attended—and I've been going for 17 years! There was so much excitement and so many new products, I've increased this month's "Scoop" from three pages to five, and I still can't get everything in! I'll save some of the new stuff to show you next time. I'm talking introductions of major products such as planes and engines. Let's face it; planes are the reason we entered the hobby in the first place—and they were unveiled in record numbers. Lots of kits and even more ARFs. Yes, like it or not—and I like it—the ARF phenomenon continues. Stay tuned; there's more to come next month.

Hot Summer Scoop 2000

New releases in record-breaking numbers

DYNAFLITE **MONSTER MUNK**

Dynaflite showed a giant fun-scale version of de Havilland's Chipmunk. According to its distributor, Great Planes, this ⅕-scale, all-wood kit features hassle-free building. Rumor has it, if you're an Art Scholl fan, as I am, the Munk can easily be built as a Super Chipmunk. The 89-inch-wingspan Chipmunk calls for a 2-stroke 1.08, 1.20 to 1.80 4-stroke or a 25cc gas/ignition engine.

NORTHEAST SAILPLANE PRODUCTS **DOUBLE YOUR PLEASURE**

Northeast Sailplane Products' gliders have always been on the cutting edge of design, and it looks as though NSP plans to keep that same pace with its slow flyers. It has now introduced the Pleaser 2—a 41-inch-span, balsa and carbon-fiber twin-boom/twin-motor ship. The 15-ounce plane has a 400-square-inch, flat-bottom airfoil and is powered by a pair of gear-reduction Speed 280s. We're talking vertical performance for only $139!

AEROWORKS **FREEDOM 3-D**

Designed by three-time world aerobatics champion Quique Somenzini, this brand-new aerobatic model from Aeroworks is a must for pilots who want to expand their flying repertoire with 3D maneuvers. It is designed for .90 to 1.50 2-stroke or .90 to 1.80 4-stroke engines and weighs 7½ to 8½ pounds, ready to fly.

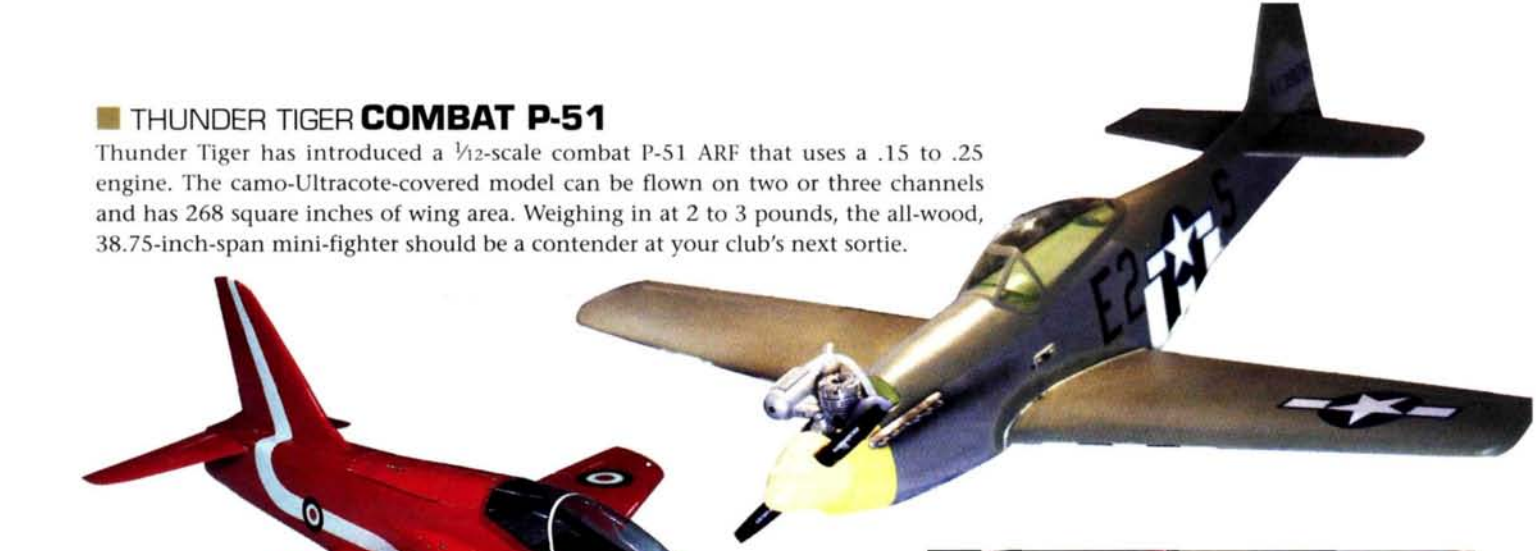
SIG MFG. **NEW ENGINE LINE AND ARF AEROBAT**

Long known for its high-quality kits and hobby products, Sig Mfg. has introduced a new line of gasoline engines. Available in 2.4, 3.2, 4.2 and 5.8ci, First Place engines are internally balanced for smoother operation, and their cylinder and piston assemblies are CNC-machined of bar-stock aluminum and steel. Each comes with a Walbro pumper carb, smoke-compatible aluminum muffler and complete electronic ignition system.

Sig's new Extra 300XS ARF was designed for 1.20 to 1.50 2-stroke or 1.40 to 1.80 4-stroke power. It has a 73.5-inch wingspan and weighs 12 to 13 pounds, ready to fly. Covered in Ultracote, the model comes with painted fiberglass cowl and wheel pants, Mylar decals, illustrated assembly manual, tempered aluminum landing gear with steel axles, hardware and even a 16-ounce fuel tank.

THUNDER TIGER **COMBAT P-51**

Thunder Tiger has introduced a 1/12-scale combat P-51 ARF that uses a .15 to .25 engine. The camo-Ultracote-covered model can be flown on two or three channels and has 268 square inches of wing area. Weighing in at 2 to 3 pounds, the all-wood, 38.75-inch-span mini-fighter should be a contender at your club's next sortie.



JET HANGAR HOBBIES **BAe HAWK ARF**

New from Larry Wolfe at Jet Hangar Hobbies is this .45-class ducted-fan jet. The fiberglass model comes out of the box just as you see it here, fully hinged and detailed; you need only add power, retracts, fuel system and radio. The Hawk is approximately 50 inches long and has a 50-inch wingspan.

ACE HOBBY DISTRIBUTORS **SEA MASTER ARF**

The re-release of this Ace Hobby Distributors amphibian should make a lot of float fliers happy. Held here by Ace's Kay Stokes, the .40-size plane has a 60-inch span and is completely built out of balsa and ply. Covered in Ultracote, the plane comes with a sturdy, blow-molded engine pod and fuel tank, spinner and wheels (it can be quickly converted into a land plane). Install a radio and engine, and head to the pond!

NORVEL **GLASSAIR 400, UCAN-2**

Ed Stevens of Norvel has moved his operation to California and into a facility that's three times the size of his old one. This can only mean more exciting products such as these two planes. The glider is Norvel's GlassAir 400 ARF; the 72.8-inch ship takes either a Speed 400 electric or one of Norvel's glow engines, and it comes in blue and red. The 25-ounce model has 455 square inches of wing area and costs $99.95.

That little one is the UCAN-2—part of Norvel's Neofun line. The $79.99 plane has a plastic fuselage, balsa wing and weighs only 24 ounces. The 41-inch ARF has 265 square inches of wing area and can be ready to fly in just two evenings. The sport plane uses either a Big Mig .061 or .074 for power and accommodates a full-size or micro 4-channel radio. Incidentally, you can still reach Norvel at the same toll-free phone number: (800) 665-9575.

OK MODELS **EZ**

Last month, I told you about the EZ's comeback to the U.S. after an eight-year absence. Now distributed by MRC, here are two additions to this high-quality ARF line. The Stingray is a sleek pattern ship with 52.5-inch wing that has 530 square inches of area; the Zero has a 59.5-inch wing that has 550 square inches of area. Both models are designed for a .40 to .46 2-stroke or a .60 to .80 4-stroke engine. The finish and detail on these ARFs are the best in the business.

KYOSHO JET-SETTER HEATHER

Here's that famous country singer Heather Rose, who also works at Hobbico, and her personal Learjet. Heather's Lear, however, is an ARF manufactured by Kyosho and powered by two, electric, ducted-fan units. The high-lift, Clark-Y-airfoil wing is 57.5 inches in span and has 573.6 square inches of area. The wing loading of this one is reported to be light.

Just like those on Kyosho's other electric-fan models, the T-33 and F-16, the Lear's fuselage and wings are made of tough styrene foam and covered in a slick, glossy coat that eliminates the need to finish it.

LANIER RC 40-PERCENT STAUDACHER AND MONSTER STINGER

You would have to have been asleep for the past several years not to know Bubba Spivey and the rest of the gang at Lanier RC are seriously into giant-scale planes. Well, towering over all of the aircraft in the Lanier booth were a 40-percent Staudacher and Monster Stinger!

The Staudacher spans an impressive 120 inches while the Monster Stinger has a 106-inch span. Both kits are of all-wood construction and feature CNC-routed and laser-cut wooden parts. Fiberglass cowl and pants are planned for the Staudacher; the Stinger's are made of ABS plastic. Formed canopies, wing tubes and landing gear are also included. Both models feature light, strong, "unitized" engine-box construction that ties the firewall, landing-gear attachment and wing-tube mount together. If your 150cc twin-cylinder, gas powerplant is looking for a home, consider these true giants from Lanier.

BOB VIOLETT MODELS SUPER SABRE

Following up on the success of its MiG 15 and Rafale B 01, Bob Violett Models showed off its new F-100D Super Sabre. Designed for either a RAM 1000, AMT Pegasus or a Jet Cat P-120 turbine engine, the F-100D has a 69-inch span and is more than 83 inches long. The all-composite model weighs 28 to 30 pounds and has panel lines and details molded in. Also included are operating wing LE slats for slow-speed stability, new scale landing gear, wheels and brakes, and wing tanks and attachment pylons.

3 SEA BEES FOCKE WULF

If you'd like to have a beautifully detailed scale model but don't have time to build one, look no farther than the 3 Sea Bees line of scale ARFs. The newest addition is this 72-inch-span Focke Wulfe, also available in German motif. The model is designed for a .60 to .75 2-stroke or .80 to .90 4-stroke and weighs 11 pounds, 5 ounces. The fiberglass-covered model comes with rivets, flying wires and other details that will make it stand out from the crowd.

CENTURY JET MODELS 1/6-scale F9F-8 Cougar

This Century Jet Models kit is so new that it was shipped to the show by Federal Express! Designed for .91 to 1.00ci engines (5-inch fan units), this all-composite jet has a 74.5-inch wingspan and is 82 inches long. It features a one-piece fuselage with a 36-inch-long cockpit/engine hatch, fiberglass wingtips, major bulkheads and intake ducting installed and sheeted plug-in wings and stabilizer. The Cougar can also be upgraded to turbine power.

HITEC SKY SCOOTER

Looking for a great airplane to get your kids or grandkids into RC flying? Hitec's new Sky Scooter is made of EPP foam, so it can handle those beginner landings, and it comes nearly ready to run (you can be airborne in minutes!). Powered by a Speed 400 motor, the Sky Scooter is a natural for stable schoolyard flying. Best of all, the model includes the motor, transmitter and radio gear, battery, charger and how-to-fly instructions—all for only about $150!

ELECTRIC JET FACTORY GULFSTREAM 4

Tell your flying buddies you're going to take the corporate jet to the field next weekend! The folks at the Electric Jet Factory unveiled this new 53-inch-span, 65-inch-long electric ducted-fan jet that's hot-wire-cut out of durable white foam. You need only add the laser-cut balsa parts and the landing gear. Two Mini Fan 480 units (or two Kyosho AP-29 fans) are recommended for power.

EDDIE A. AIRPLANE ORIGINALS DAPPER SNAPPER

This new, original design from Eddie A. Airplane Original Scale Classics certainly caught our eyes: the Dapper Snapper is a sport "racer" model with classic lines. It has a balsa and lite-ply fuselage, 60-inch foam wing and is designed for an O.S. .90 4-stroke. It weighs 8.5 pounds ready to fly and comes with landing-gear struts and ABS plastic wheel pants. The Snapper looks so "scale" that it's hard to believe it's a one-of-a-kind! It's also available in 80- and 124-inch spans.

BALSA USA 1/4-SCALE SOPWITH PUP

Built using conventional balsa and plywood construction, Balsa USA's new, great-looking WW I model has a 77-inch wingspan, is 53 inches long and has 1,985 square inches of wing area. Weighing between 12 and 14 pounds, the biplane fighter is ideally powered by a .90 to 1.20 4-stroke glow engine or a Zenoah G-23 gas burner.

CACTUS AVIATION 3W-70i GAS/IGNITION

Our good friend Bobby Wilson of Cactus Aviation showed us his new 3W-70i single-cylinder engine. The 3W-70i has a 4.4ci displacement and a Nikasil cylinder lining. Also included are a rear-mounted, reed-valve induction system and dual piston rings. Optional equipment includes Lord rubber mounts, torsional damping with twin, oil-filled shock absorbers, the Quiet Canister muffler system, twin spark plugs and dual-ignition system. This engine is suitable for 22- to 30-pound, IMAC-size performance models and is reported to turn a 26x10 Menz at close to 6,800rpm.

HORIZON **BIG SURPRISE**

There was a big surprise for everyone hanging over the Horizon booth: it was a giant, 97-inch-wingspan Extra 330L ARF. Hangar 9 has once again had the courage to take a risk by offering this ARF first, and I think it, too, will pay off, as did Hangar 9's big PT-19 ARF. We modelers *loved* that one. Designed for 62cc to 80cc ignition engines, this 23.5- to 26.5-pound model has 1,750 square inches of area.

Also in the Horizon booth was a 1.48 addition to the MDS line of motors—a line that is proving to be of good quality. Horizon claims 9,200rpm on a 16x8 APC prop.

GARY ALLEN/ARIZONA MODEL AIRCRAFTERS **BÜCKER JUNGMEISTER PLANS & PARTS**

Gary Allen's impressive 1/3-scale Bücker Jungmeister (featured in the March 2000 issue) has been a very popular plan, indeed. According to some readers, the only thing wrong with the 86-inch-span biplane is that it's just too big to be practical. Well; how about a 1/4- or 1/6-size model? The new 1/4-scale plan (FSP0300B) produces a model with a 65-inch span and looks just right for a 1.20 4-stroke or a G-23 gasser. The 1/6-scale version (FSP0300C) would be sweet with a .46 2-stroke or .60 4-stroke. But wait, there's more!

At the show, Arizona Model Aircrafters announced that it now offers engine cowls and laser-cut balsa and plywood parts for all three sizes of the model. So now, when it comes to this beautiful aerobatic biplane, you can, indeed, have it your way. For plan ordering information, visit www.rcstore.com.

HITEC **GOES DIGITAL**

Hitec adds the awesome holding power and incredible precision control of digital circuitry to the proven technology of its 925 and 945 coreless servos. The new servos have been dubbed the HS-5945MG and the HS-5925MG. Their digital specs are: HS-5945 (0.13 second at 180 oz.-in. with 540 oz.-in. of holding power); HS5925 (0.08 second at 128 oz.-in. with 384 oz.-in. of holding power).

DL AEROMODELERS **PERCIVAL MEW GULL**

This plane from DL Aeromodelers even *looks* fast! The 72-inch-span racer has an epoxy/glass fuselage and sheeted foam wings and stabilizer. The kit comes with 3/16-inch-diameter formed-landing-gear wire, epoxy/glass pants and wingtips, full-size plan and illustrated instructions. It's designed for a 1.20 to 1.80 4-stroke engine.

AVISTAR **1.80 AND 2.00**

Avistar is an engine manufacturer I've been watching closely. That's because its engines really seem to be of superlative quality and workmanship. Here are two new sizes Avistar has added to its line—a 1.80 and a 2.00. These both feature: investment-cast crankcase; precision-balanced chrome/steel crankshaft; chrome/steel piston ring; aviation-grade aluminum connecting rod with "KK" alloy bushing; and machined-aluminum twin-needle carb. They're distributed by Dave Gierke Models.

All addresses are listed alphabetically in "Featured Manufacturers" on page 134. ✦

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

STAUDACHER À LA STEWART

NASCAR Winston Cup tour fans will go to great lengths (or heights, in this case) to support their favorite drivers. Mike Smith of Gilbertsville, PA, has artfully adapted the colors of Tony Stewart's no. 20 Pontiac to his Lanier Staudacher S-600. This 25-pound aerobat is on a tour of its own, having flown twice in Valley Forge, PA, and twice in Flagler Beach, FL. Mike writes that the model is very agile and smooth in the air, and landings are slow and stable.

FLAG-RANTLY FAST

Jeff Costa of Santa Rosa, CA, shares this photo of his Great Planes Patriot. He uses an O.S. .46 FX engine and Performance Specialties Ultrathrust muffler to power this sleek plane "in excess of 100mph." The model is equipped with Hobbico retracts, JR radio gear and FMA servos, and it's covered with Ultracote. Says Jeff, "This plane is not for the meek of heart."

A REAL FLOATER

When Craig Hoisington of Rio Rancho, NM, wanted to take up float flying, he made a very practical selection when he chose the all-foam, Sure-Flite Cessna Skylane. Craig says that because this model is his first seaplane, "The more stuff that floats, the better." The model is covered with EconoKote and has an A.S.P. .32 for power. Craig overpowered the plane so that it would have enough thrust to take off from New Mexico's Cochiti Lake, which is about 5,500 feet above sea level.

CHIP IN TOGETHER

This 1/6-scale Airsail Chipmunk DHC-1 is the pride of Garnet Burke of Churchbridge, Saskatchewan, Canada. With the help of fellow modeler and instructor Ron Johnson, Garnet completed the plane in approximately 300 hours. The 69-inch-span warbird has a total flying weight of 7½ pounds and is powered by a Thunder Tiger .54 4-stroke.

FURIOUS FLYER

Richard Young of Aurora, IL, scratch-built this Hawker Sea Fury using the 3-view illustrations in the Air Age book, "Scale Aircraft Drawings." The pictured model has a balsa fuselage, but Richard has since made a fiberglass fuselage and cowl. The plane has a 59-inch foam wing covered with 1/64-inch-thick veneer and balsa flying surfaces. Richard flies the .90-powered model with a JR radio.

MAY THE ENFORCER BE WITH YOU

Ocala, FL, modeler Robert Joseph chose the Thunderbird color scheme for his Balsa USA Enforcer because, he says, "You can never go wrong with red, white and blue." The delta is powered by an MDS .68. Since the plane took only five weeks to finish, Joseph plans to follow up his T-bird with a Blue Angels version.

SUPER CONVERSION

Eric Sobol of Eureka, CA, converted his Midwest Super Stearman into this gorgeous PT-17. The Laser 100-powered biplane is covered with Stitts fabric and painted with automotive polyurethane. Eric added Robart landing-gear struts, hand-soldered window frames, a functional luggage hatch, aerodynamic flying wires, fuel sumps and fuel lines. The dummy Continental 670 radial stays on even when the warbird flies.

JUNG AT HEART

Here is a Carl Goldberg Bücker Jungmann built by Don Hoffmann of Torrance, CA. A modeler for the past five years, the 69-year-old uses an Airtronics radio to fly the 10½-pound, YS 120-powered biplane; he says it's the most complicated model he has built to date. According to Don, the plane flies great and has unlimited vertical performance but slows to a walk for landing. He says that it's very rewarding to see the plane "look so good and fly so well." The photo was taken in Don's backyard; the Los Angeles skyline is just visible to the right.

COPY CUB

This .40-size Great Planes J-3 was built by Robert E. Lee III of Florence, SC, to resemble as closely as possible his brother-in-law's full-size 1946 Cub; the 21st Century-covered plane even carries the same registration number. Robert incorporated a functional parachute drop under the plane's right wing, and he has rigged the pilot figure so that it moves along with the rudder. The model is powered by an O.S. .60 and controlled by a Futaba Skysport 6.

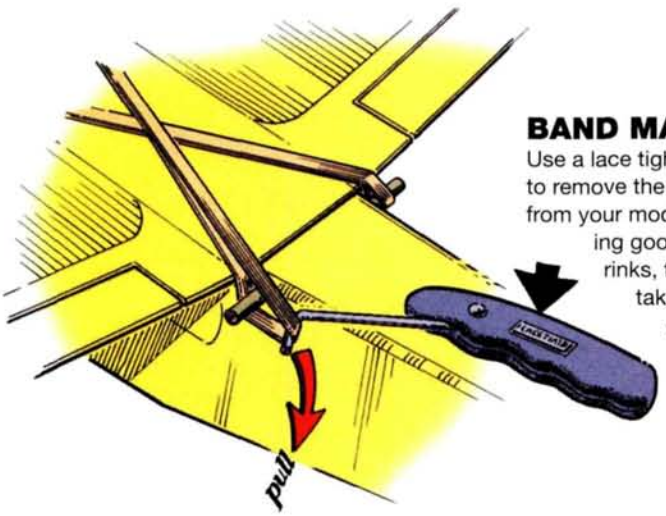
DC-POWERED DEHAVILLAND

Peter Heining, a modeler who lives in Loerreach, Germany, built this electric, ⅛-scale deHavilland DHC-2 Beaver from the Canadian Union Hobby kit. The bush plane uses an Astro Cobalt 40 that's connected to a 2:1 belt drive; this enables the motor to swing a 13x10 propeller. The 6-foot-span Beaver weighs just under 8½ pounds and is finished in Solartex. The color scheme is the same as was used on the deHavilland's 1,500th DHC-2 aircraft.

HINTS & KINKS

BY JIM NEWMAN

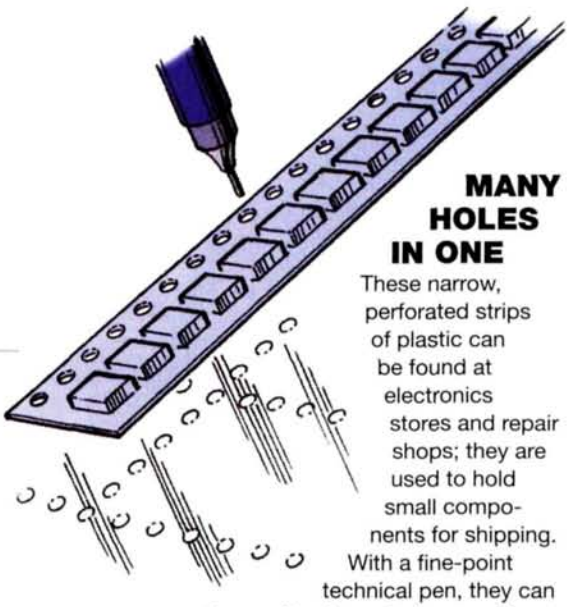
SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



BAND MASTER

Use a lace tightener for skates to remove the oily rubber bands from your model. Available at sporting goods stores and skating rinks, this folding tool won't take up much space in your field box.

Jack Dundas, Ridgeville, Ontario, Canada



MANY HOLES IN ONE

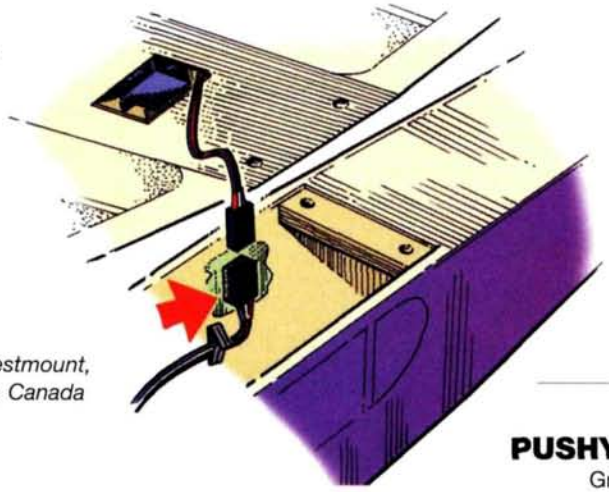
These narrow, perforated strips of plastic can be found at electronics stores and repair shops; they are used to hold small components for shipping. With a fine-point technical pen, they can be used to draw nicely spaced-out rows of ink rivets. Instead of drawing a complete circle, leave one side broken, as shown; this gives the rivets a 3D effect. Seal the ink lines with clearcoat to protect them from fuel and solvents.

Larry DeBono, Pickering, Ontario, Canada

FISHING TRIP

Avoid having to fish for that aileron servo lead by sticking it to the inside of the fuselage with double-stick tape so it will be easy to reach. The tape will bond better if you coat the area with epoxy or white glue so that it is smooth and glossy.

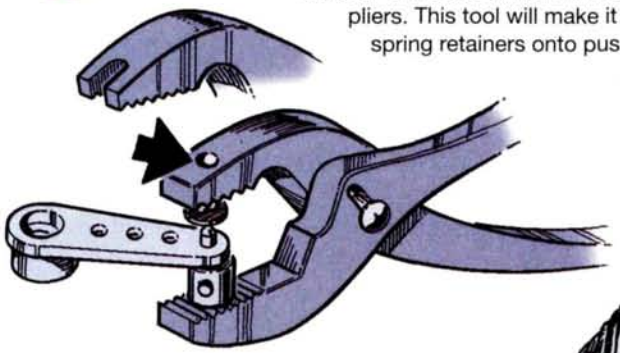
Richard Bayliss, Westmount, Quebec, Canada



PUSHY PLIERS

Grind or drill a slot or hole in the top jaw of an old set of pliers. This tool will make it much easier to press spring retainers onto pushrod connectors.

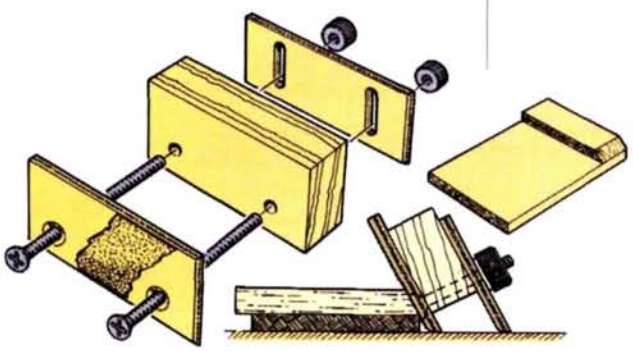
Rick Brown, Furlong, PA



A LEAN TIME

This adjustable leaning tool is used to sand a bevel on the edges of strips and control surfaces. Make it out of hardwood block and aircraft birch plywood. Be sure the screws are sunk flush so that sandpaper can be glued across the heads. The board with the backstop is used to hold the strips; it can be made out of Masonite.

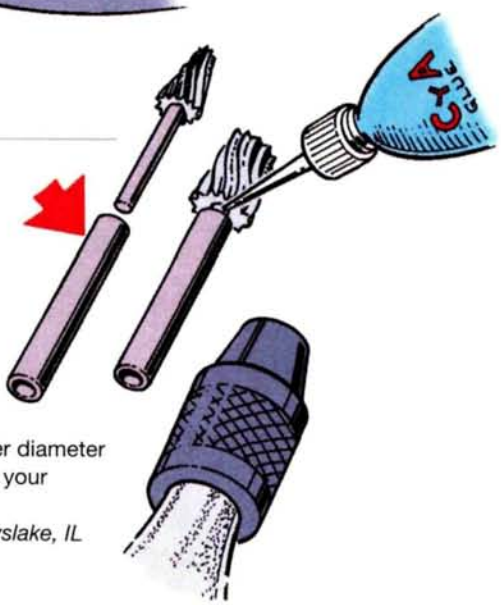
Jay Wallace, Ashland, OR

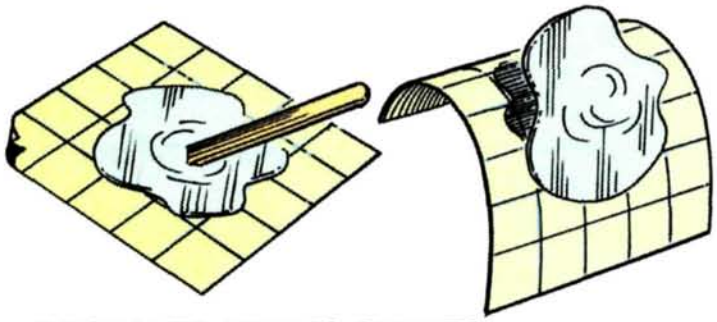


ALL THE SAME SIZE

To avoid having to constantly change collets on your rotary tool, glue 3/32-inch-i.d. brass tube sleeves onto the shafts of your cutters. This will bring the outer diameter up to 1/8 inch to match your larger grinders.

Colin Cameron, Grayslake, IL





RECYCLED MIXING SHEETS

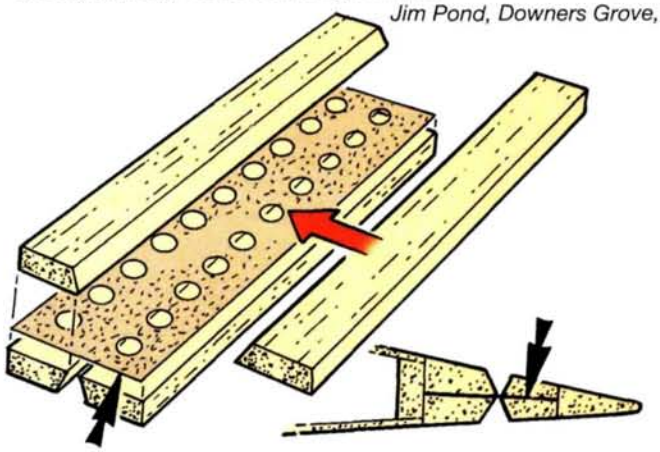
Cut squares from trim-sheet backing paper. The glossy, nonstick side is ideal for mixing epoxy. When the leftover epoxy has cured, just flex the sheet to pop it off, and the sheet will be ready to use again.

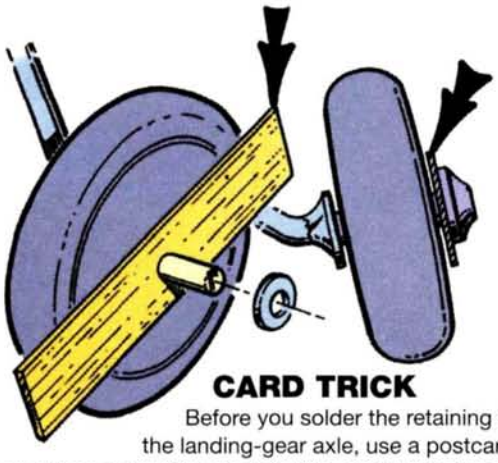
Bruce Giesecke, Columbus, NE

SEALED AND INDESTRUCTIBLE

Punch holes in strips of woven Tyvek® cut out of express shipping envelopes, then sandwich the strips between pieces of beveled balsa. Secure the Tyvek® by putting a dot of white glue in each hole before you sandwich the strips. These "sandwiches" are then glued to the trailing edges of your wings and tails and form tough, aerodynamically sealed, full-length hinges.

Jim Pond, Downers Grove, IL

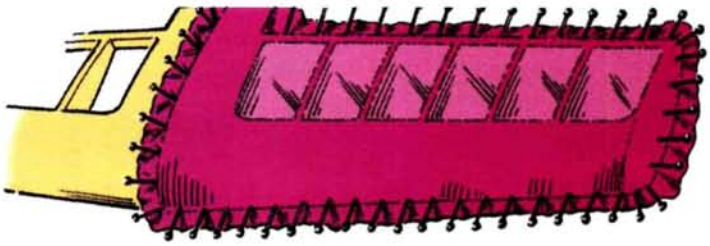




CARD TRICK

Before you solder the retaining washer to the landing-gear axle, use a postcard or a cereal-box shim with a hole in it to ensure running clearance between the axle and the wheel. Tear out the shim when you've finished soldering, apply one drop of light oil to the axle, then spin the wheel to make sure it spins freely.

Jim McCoul, Orlando, FL



SILK SKILLS

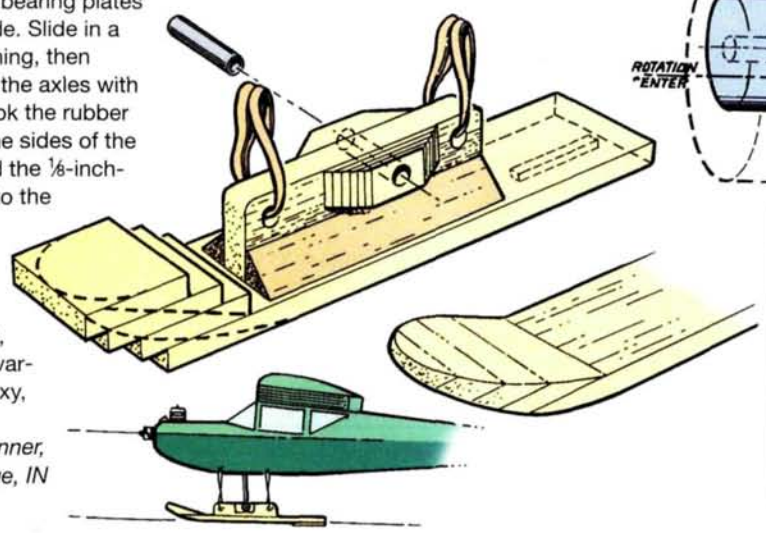
Here's an easy way to apply wet or dry silk to a structure. Gradually smooth out the wrinkles by pulling it carefully around the edges of the panel; as the wrinkles are removed, secure the silk with pins. When the silk is smooth, apply nitrate dope around the edges to secure it, remove the pins, then trim off the excess silk. Knox®-brand gelatin, dissolved in hot water according to the package instructions, is a great sealant for the weave of the silk before it is doped.

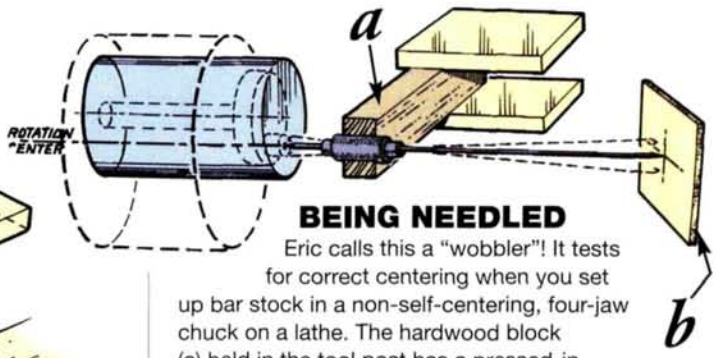
Greg Vogel, New Fairfield, CT

BREAD AND BUTTER SKI

This ski is cleverly constructed per boat builders' "bread and butter system." Laminate basswood blocks to the front of a ¼-inch (6mm) basswood plank of a suitable size, then shape the blocks on your belt sander. Add the gear mount with ¼-inch-ply bearing plates on each side. Slide in a Nyrod bushing, then attach it to the axles with collets. Hook the rubber bands to the sides of the model. Add the ⅛-inch-square rib to the ski's bottom TE to keep the model on heading, finish with varnish or epoxy, then wax.

Scott Conner, Portage, IN





BEING NEEDLED

Eric calls this a "wobbler"! It tests for correct centering when you set up bar stock in a non-self-centering, four-jaw chuck on a lathe. The hardwood block (a) held in the tool post has a pressed-in rubber bushing made of two pieces of fuel line, and a music-wire needle that's about 12 inches (300mm) long with a carefully centered point on each end. The short point engages a dimple that's centered in the crankpin so that any wobble in the long point will indicate eccentricity on the card target (b).

Eric Marsden, Horndean, Hampshire, England

What exactly were nearly 100 of the 150 enthusiasts that showed up at the Florida Jets 2000 thinking? Sure, the name was Florida Jets, but did that mean turbines? Well, in this case, it would seem so, as the number of turbines outdistanced ducted fans by at least a two-to-one margin. Is there a clear and obvious reason for this upstart RC propulsion system to experience such an incredible level of acceptance? There are reasons, but one of them isn't cost of ownership and operation. Those of you who read my turbine survey in the January 2000 issue of *Model Airplane News* probably noticed that the price of admission to this no-longer-exclusive club is quite high. Whether it's due to increased levels of disposable income, a desire to trade up, or just the plain old "gotta have it at any cost" attitude of jet modelers, turbines are growing in popularity. They are here to stay, and their future looks brighter than ever. Only a turbine engine can convincingly emulate the performance, sound and appeal of a jet aircraft. The turnout at Florida Jets proved this unequivocally!

Contrails over the Sunshine State

by Rich Uravitch

Below: the flightlines were always active. Seven were set up; four were actually used. Below center: the Eddie Weeks group getting the big FedEx DC-10 ready for another spectator-pleasing hop. It was shaped by carving blocks of foam!

FLORIDA J

Above: the demo MiG-15 from the BVM team. Its color scheme, though bright, clearly put it into the category of sport jet! Opposite page, top: from any angle, Rich Fong's Convair F-106 from the Usher Enterprises kit looked great. When Rich held the nose gear off, landings were very realistic.*

A 20-year-old de Havilland Venom built by Eric Himmler. It was formerly powered by an O.S. 91, but an AMT Mercury was installed seven flights ago. Very scale-like in flight.

Main image: unusual entry—a rarely seen A-7 Corsair II by Luis Ontiveros of Puerto Rico. The kit is produced in Europe—not imported. Below: Jack Diaz's BVM F-4 has hundreds of flights on it and is still going strong. Jack came all the way from Venezuela.

Left: Mike Barbee saved some paint from his scale YMF-5 Waco (Model Airplane News cover, March 2000) to use on his new CAI Razor. First jet Mike has tried; loves it!

ETS 2000

One of the "used jet lots" in the vendor display area. Interesting subjects here include an F-8 Crusader and an Me-262 Swallow.

One of the Kangaroo sport jets. Turbine installations don't get any easier than this; excellent flyer, unique-looking in the air.

RECIPE FOR SUCCESS

Which ingredients are required to provide a showcase for some of the hottest and most exciting flying machines that you've ever seen? Well, a great flying site is a must, and for jet operations, they don't get much better than the Flagler County Airport in Bunnell, FL, just a stone's throw north of Daytona. The affable Frank Tiano, promoter of the event, secured a big chunk of the facility from the city fathers. From flightline operation to traffic management and on-site recovery staff, all the bases were covered; the event ran more smoothly than any I've seen in a long time. The only thing that Frank couldn't get his arms around was the weather; the first two days were exceptional, but by late afternoon Saturday, the wind down the runway was blowing at a sustained 20 to 25mph! A front blew through and brought with it those terrific winds in which nothing felt comfortable being flown, except maybe a few inadequately anchored tents! On the subject of wind direction: it was surprising to me how few fliers seemed comfortable flying a right-hand traffic pattern. I had the feeling that, if the wind had been blowing from the opposite direction (dictating left-hand traffic), we might have seen a lot more flying. In spite of this, more than 400 flights were logged, most of them in the first 2½ days. That's a lot of JP-4 and glow fuel!

CAN I GET A WITNESS?

More than 1,800 spectators witnessed and enjoyed some truly interesting models and exciting flying performances. Florida Jets 2000 was a decidedly international get-together, with Argentina, Venezuela, France, the U.K. and Switzerland represented, along with the ever-present contingent from Puerto Rico headed by Felipe Vidal.

Here are a few examples of some really neat things I found while strolling around the pits and vendor area. Eddie Weeks's giant DC-10 in FedEx markings got everyone's attention wherever it was parked—even more so when it flew! Eddie literally carved this behemoth from foam blocks, hollowed things out where necessary and installed radio gear and a pair of turbines. The model flew really well. The long, slow roll and loop might have been a little out of character for the type, but they sure were impressive! Eddie employed much the same fabrication technique on a large sport jet he called "the Isobar," one of a pair that was present; the other was by Mark "Rocketman" Pokrywka. This large, relatively lightly loaded model displayed some of the most docile landing qualities of any jet there; except, maybe, for Rich Fong's F-106.

You can always count on Argentinean Gustavo Campana to show up with something exceptional. This year's entry was an equally big and beautiful Mirage 2000 from the Eric Rantet* kit and powered by the new RAM* 1000 turbine. Lurking in a secluded corner of the BVM* tent was the next scheduled release from Bob Violett Models: a really big, spectacular and scale F-100 "Hun." Though still unfinished, this Super Sabre will have available all the traditional BVM goodies such as retracts, wheels and brakes when the kit is released; it should be even more well received than its very successful F-86 predecessor. The latest from Dave Platt*, a gorgeous Hawker Hunter, is a model

Keith Horton seems to prefer the NASCAR stock-car type of finish for his jets. In addition to this Michelob Viper, he had a Winston-marked Maverick. Beautiful finishes!

The business end of Bob Violett's personal ride: an F-4J in Blue Angels Navy demo team markings.

Eric Himmler secures the hatch on his AMT-powered de Havilland Venom. This large model looked good and flew very well.

of the classic jet scratch-built from Dave's own plans. This model is sensational. If you want to build one, start drawing your own plans, as I don't think Dave intends to release the design. Too bad!

It turns out that the Ziroli* F9F Panther may have been way ahead of its time! This design from Nick Sr. goes back about eight years; I remember watching the prototype fly from our New York club field. Well, Bill Steffes built one from Nick's plans and powered it with the time-proven Dynamax*/O.S.* 91 package. The model made its initial flight at this meet in the capable hands of Dave Malchione Sr. After a long takeoff run, the big Cat got on the step and flew in a very scale-like fashion on ducted-fan power. The size of this airplane makes it a natural for conversion to turbine power.

UNIQUE THINGS

Watching the airborne activities disclosed some interesting new things. How about Antonio Tehan's* compact, lightweight, airborne device that limits speed to a preset point? Why, you ask? Well, a lot of these turbines can drive the airframes well beyond reasonable (and intelligent) speed limits; that is, the airframe will self-destruct before the engine does. A device such as this helps to ensure the safe operation of these models. Chris Huhn had one installed in his JetCat*; it was set to a mere 180mph!

To provide JP-4 for the JetCat Hammer turbine installed in his Interceptor, Kevin Whitlow fitted a functioning external fuel tank, which is great for those long, cross-country hops as well as to tidy up the interior of the fuselage.

The "sport" jet arena was dominated by ducted-fan and turbine-powered BVM Mavericks and Bandits, with well over 20 of them present. In the same category were the Golden West* Kangaroo and FiberClassics* Hot Spot models. These models look somewhat alike, as they're both twin-finned deltas with simple turbine installations. The turbines are mounted externally near the aft portion of the fuselage. Although their appearance might be unorthodox, their performance surely isn't. Charlie Rose's* smoke-equipped Hot Spot displayed astounding vertical performance and was easily tracked by its dense, white trail. Simple, all-composite construction should make this model a snap to assemble, and it appears very easy to fly.

No question about it: the turbines have ushered in a great new market for kit manufacturers. Turbine guys seem to be more interested in flying than in building, so we're seeing more and more highly prefabricated, composite airframes becoming

FLORIDA JETS 2000 SPECIAL AWARDS

Designer Achievement
Eric Himmler, de Havilland Venom

Engineering Achievement
Gustavo Campana, X-29

Manufacturer Achievement
BVM, F-4 Turbine Mod/Retro Package

Best Sport Jet Performance, Ducted Fan
Dave Malchione Jr., BVM Bandit

Best Sport Jet Performance, Turbine
Lewis Patton, CAI Raptor

Best Military Performance, Ducted Fan
Dave Malchione Sr., BVM F-4J

Best Military Performance, Turbine
Rich Fong, Usher Enterprises F-106

Best Military Jet, pre-1960
Eric Himmler, de Havilland Venom

Best Military Jet, post-1960
Gustavo Campana, Dassault Mirage 2000

Best Sport Jet
Larry Kramer, BVM Bandit

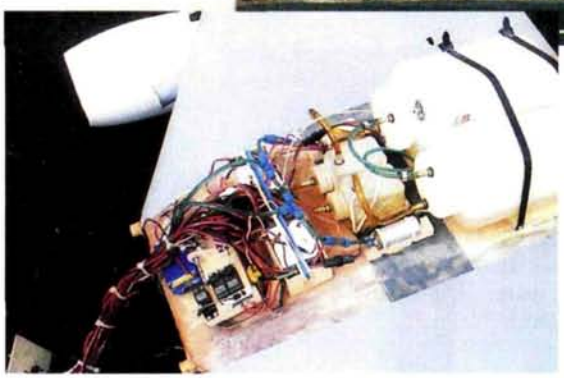
Best Civilian Jet
Eddie Weeks, DC-10

Best Multi-Engine Performance
Vern Montgomery, BVM F-4E

Critic's Choice, Ducted Fan
Dave Malchione Sr., BVM F-4J

Critic's Choice, Turbine
Sam Snyder, BVM MiG-15

The Dassault Mirage from Gustavo Campana; Eric Rantet kit, RAM 1000 turbine.



Above: flyby of the twin-turbine Eddie Weeks DC-10. The VCR strapped to the top of the fuselage yielded some really wild videos that might show up in event coverage by SKS Video. Left: turbine antipasto! The innards of the Weeks DC-10 showing fuel/oil tanks, some radio components and a lot of spaghetti!

available. One standout is the CAI* Raptor/Razor series. This sport jet is sold as a virtually complete kit to which you add radio and turbine. I'm told that minimal work is involved in assembly. About all that needs to be done is the finishing, and the model can be dressed up to look exceptional. Phil Nuza demonstrated that convincingly when he applied a Blue Angels scheme to his Raptor, which looked like a full-size Navy jet. I first saw the Raptor last year at the Toledo show when Joe Grice showed up with his finished in an Air Force SEA scheme. Fitted with external stores and a nicely done cockpit, it was very impressive and may pave the way for a new wave of "pseudo-scale" sport jets.

For many modelers, the primary obstacle to involvement with turbines is their cost. It's possible that we will see some small price reductions because of increased production, but overall, prices will probably remain the same. One supplier who has a plan to bring some costs down is RAM president Rei Gonzalez, who told me that his company will offer "refurbished" RAM 750 units, completely rebuilt to factory specifications. At around $1,895, this represents a significant savings and, at this price, will likely entice more modelers into the turbine arena.

WHERE ARE WE HEADED?

This could be the beginning of expanded interest in RC jet models. With more jet modelers changing to turbines and selling their ducted-fan equipment to finance the transition, there will likely be a lot of "previously owned" fan/engine packages available at good prices. Take a look at George Leu's article, "Getting Started in Ducted Fans," in the May 2000 *Model Airplane News*; it should convince you that there's plenty of product available to introduce you to jets. Although the Florida Jets meet was overwhelmingly biased toward turbine power, for a variety of reasons, turbines are not for everyone. If we look at RC jet activity as a movement to be expanded, instead of making a distinction between ducted fans and turbines, everyone is likely to benefit.

I have never returned from a meet as impressed as I was with this one. It was well run and well attended—a promoter's dream. A lot of people and companies made it happen. Please note the sponsors listed below and remember that they're the folks you can—and should—put your confidence in, as they really do have an interest beyond simply selling you something.

Plans for Florida Jets 2001 are already underway. If you want to get the real scoop on jets, plan to attend next year. (Stay posted for dates and other information.) Give jets a try; the timing couldn't be better!

Enjoy the highlights of Florida Jets 2000 with this video from SKS*.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 134.*

SPONSORS

PLATINUM
Pacer (Zap Gang), *Model Airplane News*
RA Microjets (RAM), BVM

GOLD
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One of the prettier sport jets at the meet was this CAI Raptor by Phil Nuza. Blue Angels team markings just seem to look "right" on any jet!

speed

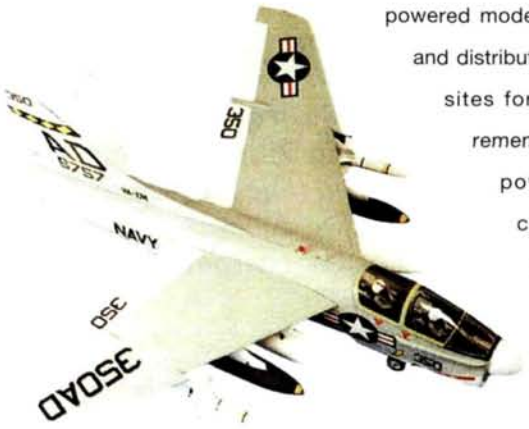
Graupner's direct-drive Speed 400 and Cam folding propeller offer excellent pull and minimal drag.

by Bob Aberle

Sanyo's 500AR fast-charge Ni-Cds are popular for their overall power and duration.

It's no surprise that Speed 400 motors have become incredibly popular; these versatile power systems can be used with scale and sport models, gliders, pylon racers and even jets! The availability of reliable, lightweight radio components adds to the convenience and appeal of these small electrics, and recent advances in batteries and speed controllers have greatly increased flight duration and performance. These models are generally inexpensive, easy to build and easy to transport, and many of them can fly in smaller areas such as schoolyards. Because this class of aircraft is continually expanding, the accompanying charts highlight only 120 of the available Speed 400-powered models; check out manufacturer and distributor advertisements and websites for additional aircraft. Also, remember that many small glow-powered planes are great candidates for Speed 400 conversion.

Former free-flight designs like the Buzzard Bombshell from Spirit of Yesteryear* make good RC conversions because of light weight electronics.



Compact and efficient power systems keep the flying weight of this Electric Jet Factory A-7 to 1 pound or less!

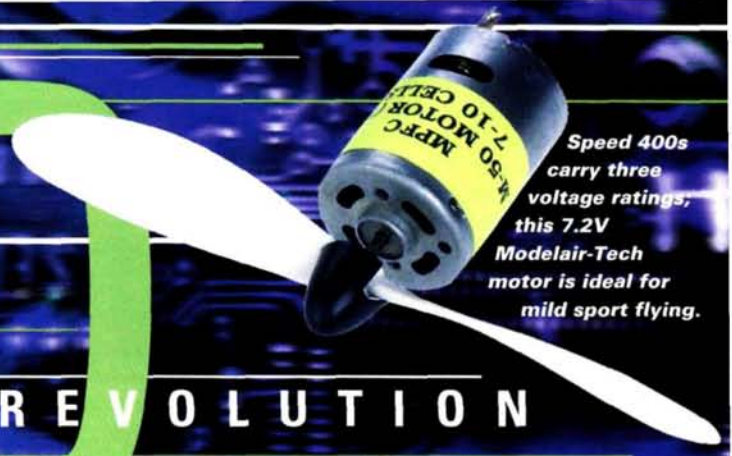
Because the motor-system components (motor, gearbox, prop, ESC and battery pack) weigh 10 to 13 ounces, the total typical flying weight of a Speed 400-powered model ranges from 15 to 30 ounces. Some of the specialty pylon racers weigh even less than 15 ounces, and even a 16-ounce model will be a hot performer. For a direct-drive application (more on this later), 20 ounces is a good upper limit, while 30 ounces is about maximum when you use a gear- or belt-drive reduction system.

From a size standpoint, a pylon racer might have only 100 to 150 square inches of wing area, while a powered glider or an old-timer might have more than 400 square inches. General sport models will tend to have between 200 and 300 square inches of wing area.

A belt-reduction drive such as this Modelair-Tech H-100 enables the Speed 400 to turn larger props.

Pilots can quietly wage their own WW II dogfights. JK Aerotech's* P-51 is a great kit to convert to use Speed-400 power.

400 REVOLUTION



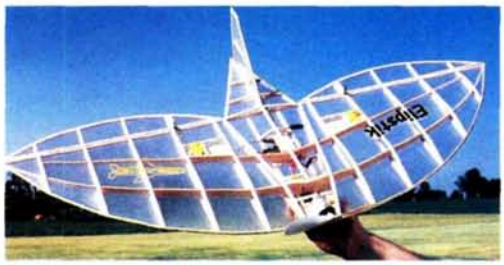
Speed 400s carry three voltage ratings; this 7.2V Modelair-Tech motor is ideal for mild sport flying.

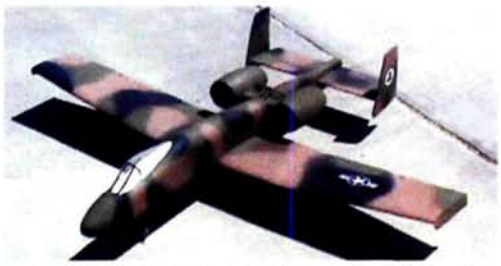
STAND-OFF SCALE

MANUFACTURER/DIST.	KIT	WING AREA (sq. in.)	SPAN (in.)	WEIGHT (oz.)	NO. CELLS/mAh	PRICE	REMARKS
Aerocraft	Eastbourne Mono	321	43.5	20	6/600	$44.95	Kit
	Eindecker (not yet available)	350	45	20	6/600	$44.95	Kit
	Farman 400	280	43	20	6/600	$44.95	Kit
	Piper Super Cub	312	46.5	19	6/600	$44.95	Kit
Dave's Aircraft Works	Extra 300S	150	30	16	7/500	$49.95	Kit
	Staudacher S300	150	30	16	7/500	$49.95	Kit
	ME-163 Komet	432	49	22	6/600	$59.95	Kit
Dymond Modelsport	Aeronca	275	41	17	8/500	$99.95	ARF w/drive system
	B-25	456	53.5	28	7/2000	$239	2 gear-drive 400s
	BD5	345	42.5	18	7/1400	$199	Motor and prop
	Cessna 150	265	41	17	8/500	$99.95	BEC/motor/prop included
	Cessna 172	265	41	16.5	8/500	$99.95	BEC/motor/prop included
	Cessna Bird Dog	265	41	17	8/500	$99.95	ARF, BEC/motor/prop included
	DC-3	450	52	22	7/2000	$229.95	ARF/2 motors/props
	Helio Courier	305	45	15	8/500	$99.95	ARF
	Islander	450	54	19	7/1400	$209	2 motors and props included
	Morane	380	43.2	13.6	6/350	$84.95	Motor, gear, prop included
	P-38 Lightning	400	48.1	21	7/2000	$229	2 motors and props included
	PBY Catalina	467	55.2	23	7/2000	$229.95	2 motors and props included
	Piper Cub ARF	278	41	17	8/500	$99	blue or yellow
	SE-5	560	36.4	19.7	6/350	$84.95	Motor/gear/prop included
Electric Jet Factory	A-7	125	28	16	8/600	$69.95	Power system; $29.95
	A-10	200	41	35	8/1250	$89.95	ARF
	F-16	96	19	16	8/600	$69.95	Pusher or fan
Herr Engineering	AT-6 Texan	190	36	18	6/600	$61.95	Laser-cut kit
	Piper Cherokee	293	42	21	7/600	$61.95	Laser-cut kit
	Piper J-3 Cub	328	48	22	7/600	$62.95	Laser-cut kit
	P-51 Mustang	303	42	22	7/600	$62.95	Laser-cut kit
Hobby Club	L-4	250	40	24	7/500	$159.95	ARF
	Piper J-3 Cub	250	40	24	7/500	$159.95	ARF
	Super Cub	250	40	24	7/500	$159.95	ARF
	Zlin 212	188	40	22	7/600	$149.99	ARF
Hobby Hangar	Piper Super Cub	236	40	20	7/600	$34.99	Kit
Hobby Lobby	B-25	510	53	50	8/1700	$249	ARF, 2 Speed 400s
	Grumman Albatross	452	56	48	8/1900	$199	ARF, 2 Speed 400s
	Junkers Ju-52	403	59	56	8+/800	$159	ARF, 3 Speed 400s
	Osprey Flying Boat	323	43	31	8/800	$119	ARC
	P-38	324	48	46	8/1700	$219	ARF, 2 Speed 400s
	Super Cub	312	47	21	6/600	$29	Kit
JK Aerotech	P-51B	256	38	25	7 to 8/600	$29.95	Kit, 1/12-scale
K&A Models Unlimited	OV-10 Bronco	335	43	39	7/1700	$79.99	Kit, 2 Speed 400s
	ME-109 "5"	163	31	19	8 to 10/500	$89.99	Kit
	P-38	350	50	41	8 to 10/500	$199.99	Kit, 2 Speed 400s
	Spitfire Mk. XXIV	172	31	21	20 to 22/500	$89.99	Foam and glass kit
	Stephens Akro	198.36	34	26	8 to 10/500	$119	Foam and glass kit
Modelair-Tech	Perc. Mew Gull	205	37	21	8 to 10/500	$27	Plastic parts and plans
Northeast Sailplane	Piper Cub J-3	257	40	26	7 to 8/600	$149.95	ARF
	Zlin 212	217	40	23	7/600	$169.95	ARF
Todd's Models	Bearcat	170	30	18	7 to 8/600	$70	Kit
	Corsair	170	31	18	7 to 8/600	TBA	Kit
	Hellcat	168	30	18	7 to 8/600	$70	Kit

SPEED 400 REVOLUTION

Many have categorized the Speed 400-class size as "½A electric" because the power produced by a Speed 400 motor is roughly comparable to that of a .049 glow engine. Speed 400 motors can be found under many brand names and are available in three voltage windings: 4.8, 6 and 7.2 volts (more on this in a moment). Best of all, the basic motor usually costs about $10; the can is sealed, so it can't be repaired. When you wear out a Speed 400, you simply replace it.





Left: Modelair-Tech Elipstik. Right: Speed 400 motors make twin-ducted-fan applications like this Electric Jet Factory* Mini A-10 relatively inexpensive projects.

Speed 400 motors are used in a variety of applications. The lower-voltage (4.8V) motors are almost always used with lower ratio gear- or belt-reduction drives and smaller props. The mid-range, 6V winding motor on direct drive is good for pylon racers, and with moderate gear- or belt-reduction ratios and 7- to 9-inch-diameter props, it's a good choice for faster models. The highest-voltage winding motors (7.2 volts) are intended for milder sport flying, and these usually have higher gear- or belt-reduction ratios and are used with larger, usually 9- to 13-inch, props. These motors have more endurance.

Speed 400 motors are easily run "direct" (motor shaft to prop), without a gear- or belt-reduction drive. A 6x3 folding prop, 6V winding motor and 7 cells are good for direct-drive operation. To enhance Speed 400 operation, however, there's a variety of available gear-reduction drives. These allow you to use larger props that turn more slowly and draw less current yet develop more thrust. In other words, the proper reduction drive can lift a heavier model longer. Gear

SPORT /FUN FLY

MANUFACTURER/DIST.	KIT	WING AREA (sq. in.)	SPAN (in.)	WEIGHT (oz.)	NO. CELLS/mAh	PRICE	REMARKS
Bill Griggs Models	Assault	201	32.5	15	7 to 8/600	$55	Motor/gearbox $29.95
	O.T. Racer	240	42	20	7/600	$60	Motor/gearbox $29.95
Bowman Hobbies	Scooter Electric	252	36	12	8/500	$64.95	EPP foam construction
Cavazo's Sailplane Design	Twister 400	170	34	16	7/600	$69.95	Bagged wing $109.95
Clancy Aviation	Yard Bee	270	29	14	8/500	$54	Balsa kit
Delta Wings	F-16 Delta	320	28.5	24	10/500 to 600	$70	3-piece foam construction
Diversity Model Aircraft	Butterfly	310	31	12.5	6 to 7/600	$74.95	Kit
	Dragonfly	450	48	15	7/600	$69.95	Kit
Dymond Modelsport	Handy	425	48	13	8/500	$129	ARF
	Cri Cri	560	56	20	7/2000	$179	ARF, 2 motors and props
FMA Direct	Razor 400	447	48	20	7/600	$44.95	Available ARF and RTF
Graupner	Low-Wing Skimmer	342	59	24	6/600	$79	Kit
Hobby Lobby	Comet Jet	415	53	53	10/1000	$199	2 Speed 400 ducted fans
	Elinor	390	54	31	8/1200NiMH	$109	ARF
	Fokker	251	38	20	7/600	$109	ARF
	Loop	254	31.5	24	7/600	$79	Kit
	Miss 2	396	54	29	8/1200NiMH	$99	ARF
	Wingo	400	43	20	8/600	$119	ARF, foam construction
K&A Models Unlimited	Rebel	224	32	17 to 18	7/500	$59.99	Kit
Kavan	Wingo	400	43	20	8/600	$119	ARF
Kyosho	Ferias	296	39	21	7/600	$99.95	ARF
Lanier	Shrike	162	24.5	14 o 19	6/600	$35	Kit
Modelair-Tech	Dimwatt	231	34	15 to 20	6 to 8/500 to 600	$24.95	Stick balsa construction
	Elipstik 460	460	43	10 to 12	6/500 to 600	$27.95	Stick balsa constuction
	Le Parquewatt	335	48	16 to 20	6 to 8/500	$29.95	Stick balsa construction
	Lowwatt	203	38	15 to 20	6 to 8/500 to 600	$24.95	Stick balsa constructon
	Tumblewatt	208	27	12 to 14	6 to 7/500	$24.95	Stick balsa construction
	Twin Dimwatt	250	38	22 to 26	8/600 to 800	$27.95	2 motors, stick balsa kit
Multiplex	Pico Jet	312	35	18	7/500	$79.95	Speed 400 pusher prop
	Smiley	620	56	51	7/1400	$123.33	2 Speed 400s
	Teddy	390	49	20	6/600	$62.75	Foam trainer
	Twin Star	620	56	49	7/1700	$93.98	2 Speed 400s
	Hummel	390	54	29	6 to 7/600 to 800	$120	ARF
Northeast Sailplane	Diablotin Micro	366	33	21	6 to 7/600	$169.95	ARF
	Miss Europa	396	54.3	26	7 to 8/600	$94.95	ARF
	Peeper	215	39	16	6 to 7/600 to 800	$199.95	ARF
Norvel	Folding Flyer	285	30	16 to 19	8/500	$19.99	Fast build kit
Spirit of Yesteryear	Buzzard Bombshell	354	47	20	7 to 8/600	$60	Balsa/ply kit
	Dallaire Sportster	341	52	20	7 to 8/600	$59.95	$110 w/motor
SR Batteries	X250	250	36	20 to 24	8 to 10/500	$69.95	Aileron version $79.95
Todd's Models	Twist	411	42	20 to 25	7 to 8/500 to 1K	$89	Flying wing
Trick R/C	Razor EL	292	30	17	7 to 8/600	$75	Semi-kit and motor
	Zagi 400	407	48	19	7 to 8/500	$135	$75 for semi-kit

POWERED GLIDER

MANUFACTURER/DIST.	KIT	WING AREA (sq. in.)	SPAN (in.)	WEIGHT (oz.)	NO. CELLS/mAh	PRICE	REMARKS
Altech Marketing	EZ Bali	376	61.5	21.5	6/600	$205	ARF, MSRP listed
Delta Wings	Sport Pilatus	600	72	36	7/1100	$70	Kit, V- or T-tail
Dymond Modelsport	Flipper	392	56	20	8/500	$109	ARF, motor, prop
	Grob	420	60	18	8/500	$169.95	ARF
	Last Down	545	62	15	8/500	$199	ARF high-perf. glider
	Up'naway	430	60	14	8/500	$169	ARF
	Vivat	460	76	22	8/500	$179.95	ARF
	Flipper	392	56	20	8/500	$109	ARF motor/prop included
Hobby Lobby	High-Wing Skimmer	342	59	19	6/600	$21.90	Kit
	Low-Wing Skimmer	342	59	19	6/600	$27.90	Kit
	Timothy 400	400	59	24	7/500	$79	ARF
ICARE Sailplanes	Carbon D-Light	440	60	20	7/600	$185	RTF
K&A Models Unlimited	Odyssey Electric	370	60	22 to 24	7/500	$69.99	V-tail, balsa fuse
	Voyager Electric	370	60	22 to 24	7/600	$99.99	Kit
	Voyager Pro	370	60	19 to 22	7/600	$99.99	Kit, glass fuse
Modelair-Tech	Soarwatt	360	60	18 to 20	7/500	$24.95	Kit
	Super Soarwatt	439	68	22 to 24	7 to 8/500 to 600	$27.95	Kit
Northeast Sailplane	Electron 400	380	60	21	7/600	$149.95	ARF, aileron $199.95
	ASW24E	296	63	15	7/500	$199.95	ARF
	Blues 400	375	60	20	6/650	$199.95	ARF
	Mini Silent Dream	385	61	21	6/650	$179.95	ARF
	Monarch E	388	59	20	6/650	$209.95	ARF
	Neon 400	390	59	24	6 to 7/650	$69.95	Kit
	Omen	418	68	25	7/600	$209.95	ARF
	Orion E	467	72.5	24	7 to 8/600	$199.95	ARF
	Softik EL	315	54	13 to 15	7/600	$109.95	ARF
	Sting S-400	455	73	25	7/600	$129.95	ARF
Norvel	GlassAir 400	455	72.8	26	8/500	$99.95	ARF
Sobox	Accent 400 RTF	400	60	8	7/600	$249	RTF
Spirit of Yesteryear	Miliamptique	291	46	18 to 20	6/600	$50	Kit
SR Batteries	X-440 ARF	440	68	23	7 to 8/500	$199.95	ARF

PYLON RACING

MANUFACTURER/DIST.	KIT	WING AREA (sq. in.)	SPAN (in.)	WEIGHT (oz.)	NO.CELLS/mAh	PRICE	REMARKS
Bill Griggs Models	Rocket	135	28	13 to 17	7/600	$65	Kit
Diversity Model Aircraft	Skat Racer	98	28	15	7/500	$69.95	Kit
Dymond Modelsport	Adrenalin	125	30	7	8/500	$199	ARF, carbon spinner
	Adrenalin Eco	140	30	8	8/500	$139	ARF
K&A Models Unlimited	Evolution	162	31	15 to 17	7/500	$59.99	Kit
Modelair-Tech	Bare Bones	160	30	14 to 16	7/500	$25.95	Kit
SL Model	Traffik	164	28	20	7/600	$119	RTF
Cavazo's Sailplane Design	Switchblade	118	27	13	7/500	$109.95	ARC

drives (and Speed 400 motors) are offered by such companies as: Hobby Lobby* (Graupner*, Mini-Olympic), Maxx Products*, Dymond ModelSport USA*, Northeast Sailplane*, MTM Intl.* and Modelair-Tech*. Depending on the reduction ratio you use, it is possible to use up to 14-inch props on Speed 400 motors.

For power packs, 7 to 8 cells seem to work well. At 5 ounces, the Sanyo* 7-cell 500AR pack is quite popular. Also around that weight is the Sanyo 7-cell 600AE pack, but an even better choice is an 8-cell, 1200 to 1500mAh nickel-metal-hydride (NiMH) pack, which weighs only about 7.5 ounces. Generally speaking, Speed 400 motors draw an average current of 10 amps. A typical 500mAh pack might give you a 3-minute flight, while a 1500mAh pack might be capable of close to 9 minutes—wow!

Gear-reduction drives perform a similar function to the belt units; this particular gearbox turns at a precise 2.3:1 ratio.

Many electric motor speed controllers (ESCs) are now available for use with Speed 400 motors. For this application, an ESC should be capable of handling at least 10 amps of motor current on a continuous basis. Most will operate on at least 6 to 8 cells, and most will have a BEC circuit that allows the motor battery to also power your RC system. Some of the manufacturers or distributors of these ESCs include: Astro-Flight*, Hobby Lobby*, FMA Direct*, Castle Creations*, Gordon Tarling*, Modelair-Tech, Sirius Electronics*, Dymond ModelSport USA, Northeast Sailplane, Kontronik* and Viper Model Products*.

Norvel's* impressive GlassAir 400 is the latest to hit the market.

If you don't already have a Speed 400-powered model in your hangar, I hope this article will inspire you to try one of these inexpensive, no-hassle, silent flyers.

The addresses of the companies featured here are listed alphabetically in "Featured Manufacturers" on page 134. ✈

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

Thunder Tiger GP-07

by Randy Randolph

Dependable power in a small package

Over a year ago, the folks at Thunder Tiger* slipped the first experimental production GP-07 out of an oily plastic bag and displayed it at the rear of their booth at the Toledo Weak Signals Show. It didn't have a muffler or a needle, but it did look nice! The finished product looks even better; it comes with a tightly fitting, bolt-on side-exhaust muffler, a radial mount extension, fuel line and an all-purpose wrench—all well-packaged in a stout box.

The latest addition to the Thunder Tiger line of engines, the GP-07 joins the parade to downsize the expense of RC flying (enlarged for detail).

This is a modern engine that's made with state-of-the-art materials and all CNC manufacturing. It features Schnuerle porting, an ABN (aluminum-brass-nickel) piston and cylinder for long wear and bronze bearings for maintenance-free operation. The carburetor has an air bleed for precise idle adjustments and a needle valve that's angled away from the prop arc for safe engine tuning.

The ready-to-run GP-07 weighs in at 3½ ounces and can be installed with the supplied backplate radial mount or by using a standard beam mount. The supplied radial-mount extenders hold the GP-07 away from the firewall when it's mounted in that manner. The beam mounts are slotted, so they offer some flexibility. Both mounts are well-engineered, and the mounting screws are easy to access.

The muffler has a pressure tap already installed. Two bolts with lock washers anchor the muffler to the crankcase. The exhaust can be adjusted to exit in the most convenient direction for the engine installation. The muffler is a tight fit to the exhaust port and works very well; this is a quiet engine!

The GP-07 uses a standard RC short plug, but the plug is mounted a little differently from most engines. The top head fins are threaded into the top of the case, and they hold a floating head that contains the glow plug. To access the plug, you hold the top fins steady with the provided wrench while using a standard four-way wrench to remove the plug. If you don't use the wrench, you will likely remove the top fins and floating head without moving the plug, and it will be very difficult to remove the plug from the floating head without damaging it. Keep

PHOTOS BY WALTER SIDAS & RANDY RANDOLPH

Above: my simple hardwood test mount includes a medicine-bottle fuel tank. The mount can be clamped in a vise or anchored to a bench when in use; the engine is held in place with long wood screws. Left: the offset needle-valve assembly is angled away from the propeller arc and allows you to safely adjust the engine—a nice feature.

SPECIFICATIONS

Engine: GP-07

Manufacturer: Thunder Tiger

Displacement: 0.07ci

Bore: 0.472 in.

Stroke: 0.393 in.

Practical rpm: 3,000 to 18,000

Output (bhp/rpm): 0.19/17,000

Length (backplate to thrust washer): 1.85 in.

Crankshaft thread: M4x0.7

Beam width: 0.76 in.

Crankcase width: 13/16 in.

Weight w/muffler: 3.33 oz.

Price: $49.99

Features: Schnuerle porting; ABN piston and cylinder; bronze bearings; swept-back needle valve; bolt-on muffler; beam or firewall mounting options; air-bleed carburetor; purple-anodized cylinder and spinner.

Hits

- Low price.
- Angled needle valve for safe adjustments.
- Smooth throttle response.
- Adjustable engine exhaust.
- Easy to start.

Misses

- Glow plug is somewhat tricky to remove.

the supplied wrench in your flight box; it also handles many other engine chores.

I followed the break-in procedures that are outlined in the instruction sheet that comes with the GP-07 and ran the bench tests using PowerMaster* fuel that has 15 percent nitro and synthetic as well as castor oil. The fuel line is attached to the carb in a different way from most engines: it's up front and handy! Initially, I flooded the engine before I found an addendum sheet slipped into the instruction packet that said to change the initial needle setting from 2½ turns to 1½ turns open. The start was immediate! From the initial start to the end of the session, starts were quick—hot or cold!—and the engine didn't show any signs of overheating.

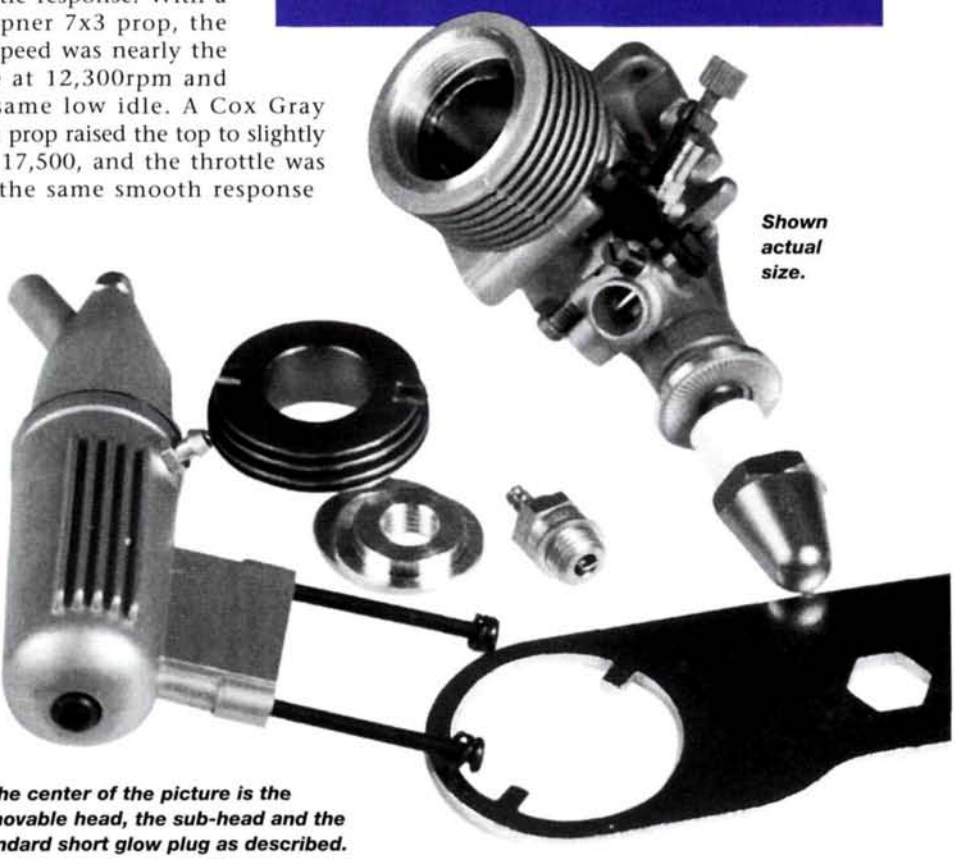
After half an hour of break-in, a Cox Gray 7x3.5 propeller showed a top speed of 12,200rpm. The throttle response was smooth and gradual down to a very solid idle of 3,700rpm—a very nice throttle response! With a Graupner 7x3 prop, the top speed was nearly the same at 12,300rpm and the same low idle. A Cox Gray 6x3.5 prop raised the top to slightly over 17,500, and the throttle was still the same smooth response down to a very solid idle of 3,800rpm. A Graupner 6x3 and a Master Airscrew 6x3 showed a very slight improvement, with top speeds up to 12,350 and the same low idle. I had to use a reamer to slightly enlarge the mounting holes in the Cox and Master Airscrew propellers to fit the GP-07 shaft. The mounting holes in the ½A-size APC propellers are too large for this engine, so rather than risk an off-balance propeller, I didn't test them. Propellers down to 5 inches in diameter are recommended for racing, but since I had none on hand, these sizes were not tested, although interpolation would indicate a top rpm from 19,000 to 20,000. The test results indicate that the GP-07 runs well. I look forward to installing this versatile engine in my next small project.

Addresses are listed in "Featured Manufacturers" on page 134. ✦

TEST RESULTS

PROPELLER	TOP RPM	IDLE RPM
Cox Gray 7x3.5	12,200	3,700
Graupner 7x3	12,300	3,700
Graupner 6x3	12,350	3,800
Master Airscrew 6x3	12,350	3,800
Cox Gray 6x3.5	17,500	3,800

The GP-07 can be installed using a standard beam mount or with the supplied backplate radial mount (enlarged for detail).



Shown actual size.

In the center of the picture is the removable head, the sub-head and the standard short glow plug as described. The wrench is included with the engine.

A ducted fan-tastic electric jet

by Todd Long

The F-16 remains a popular subject among RC pilots. There are glow-engine, ducted-fan models of the "Fighting Falcon" in tractor and pusher configurations; even turbine-powered and power-scale slope versions are available. Now, Kyosho® has added its new Electric Ducted-Fan (EDF) F-16 to the market. The jet is a follow-up to Kyosho's T-33, a former "Model of the Year"; the F-16 uses the same fan unit and motor.

KYOSHO F-16

To begin with, I'll tell you that I have been flying gas-burners of all sizes for about 20 years and micro electrics for the last two. This is my first foray into the "bigger" electrics, and also my first ducted-fan model.

The instructions are in typical Kyosho-style; very little text but great drawings. Symbols draw your attention to important construction notes at every step. The F-16 is not a challenge to build and fly for the intended intermediate-to-advanced modeler. Just make sure you understand each step completely before you apply a knife or glue. The kit consists of eight pieces: the wings, stab halves, fuselage sides, rudder and the fan unit. The F-16 is made of molded Styrofoam with a hard plastic shell on the outside (think M&M's candies here). Two full-color decal sheets and the hardware to finish the plane are included.

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

The F-16 hand-launches very easily. Get to a slow jogging pace and give the jet a firm, straight toss. Do not try to pull up or do a tight turn immediately after launch; the F-16 needs to gain a little airspeed first. When the jet has reached good airspeed, climb a little and do some basic turns to get used to its reactions. When you do tight turns, the airspeed decreases quickly, and it takes a little time for it to pick back up. Just think of it as driving a car that is stuck in high gear.

The landings require a little bit of planning, since the glide is flat and a little on the fast side. Just make the turn to final a little farther out than you normally would and keep a straight heading down the runway. Flare for landing just as you would with any other plane. I like to do touch-and-go's! All this requires is a faster than normal landing speed and application of full power as soon as the F-16 bounces off the grass. The skid on the bottom really helps keep the plane tracking straight while landing.

SPECIFICATIONS

Model: F-16 Fighting Falcon

Manufacturer: Kyosho

Type: ARF electric ducted fan

Wingspan: 36.8 in.

Wing area: 302 sq. in.

Weight: 2.48 lb.

Wing loading: 19.13 oz./sq. ft.

Length: 35.4 in.

Radio req'd: 3-channel

Radio used: Futaba® 8UAH w/Hitec 555 receiver and HS-85MG servos

Speed control req'd: 30A capacity aircraft

Speed control used: AstroFlight® 215D

Power system: LeMans AP29L w/ducted-fan unit (included)

Retail price: $249.99

Street price: $199.99

Features: molded white and red styrene foam structure with hard plastic outer shell; plywood spars and fuse reinforcements; complete hardware and illustrated 12-page instruction manual.

Comments: quick-building aircraft with attractive scale appeal. A relatively inexpensive introduction to jet flying.

Hits

- Complete hardware included.
- Nice 2-sheet decal set.
- Hard plastic covering looks like fiberglass.
- Stand protects jet during shipping, building and displaying.

Misses

- Lack of jet-flying tips in instructions.

ASSEMBLY

Since the whole plane is pretty much assembled with epoxy, be sure to pre-fit everything before it's glued. I put a small amount of epoxy on each surface instead of a heavy coat on just one. This gives a better glue joint and creates less mess. I also keep some rags and rubbing alcohol nearby to wipe off any excess epoxy that may squeeze out or run.

I always break in my electric motors before the first flight. The motor and brushes not only last longer, they also supply more power. I broke in the F-16's motor by running it without the fan, powered by two D-cell alkaline batteries. I ran the motor until the brushes were fully seated against the commutator; it can take a few hours.

• HIGH-SPEED PERFORMANCE

As with all jets, speed, for me, is what counts. Kyosho's F-16 does not accelerate quickly, but I'm really impressed by how it holds its speed after a dive. High-speed, low-altitude passes are just too much fun. Although the jet is faster than I had hoped, I may try for more speed with one of the new AstroFlight 05 brushless motors.

• LOW-SPEED PERFORMANCE

The F-16 slows down to quite a reasonable speed because of the wing's Clark-Y airfoil. If flown too slowly, the jet will drop a wingtip. I recommend that you practice stalling the jet a few times up high. Stalls are very predictable and easily corrected; it just takes time to recover. Keep the elevator travel at the recommended settings for the first few flights until you get used to the F-16's flight characteristics.

• AEROBATICS

The F-16 performs most aileron and elevator aerobatics. Rolls are easy, but loops require a slight dive to build up enough airspeed to get "over the top." Inverted flight is good, but the jet requires a bit of down-elevator to stay level because of the Clark-Y airfoil. On my next F-16, I plan to add a rudder so I can perform high-speed knife-edges.

While the motor was breaking in, I figured it was a good time to balance the fan. I placed the spinner on the rotor hub and placed the assembly on a prop balancer. Instead of adding weight, I rotated the spinner on the rotor hub until the unit balanced properly. I then marked the rotor and spinner so that I could reassemble it in the balanced position. With the motor broken in and the rotor balanced, I assembled the fan unit. Remember to use Loctite* on the screws to prevent the hub from loosening.

Left: the F-16 comes complete with brightly colored plastic-over-foam assemblies, high-quality graphics and the complete motor and fan unit. Above: if you desire a different look for your jet, the plastic covering on the foam components accepts paint readily. Assistant editor Bob Hastings airbrushed this jet with Parma* FasKolor.

MAIN STRUCTURE

With a no. 11 blade, I cut the fuselage openings as instructed. It's easier to cut the fuselage from the inside, laying the blade flat against the fuse as a guide. Trim the foam slowly and change your blade often. When it's time to epoxy the two plywood wing spars into each fuselage half, it's absolutely imperative to have a straight and strong spar joint. Be generous with the epoxy and careful with the alignment.

Before you join the fuselage sides, install the elevator servos; otherwise, you'll have to fit your hand into the access hatch to route the wires and extensions.

Install the hatch cover before you decal the bottom of the fuse. Note that a stamped arrow points toward the nose of the plane. Once the lower decal has been affixed, cut the decal along the outline of the hatch. Take your time; the F-16 has many compound curves, and because some of the decals are large, it takes a lot of care and attention to apply them without wrinkles.

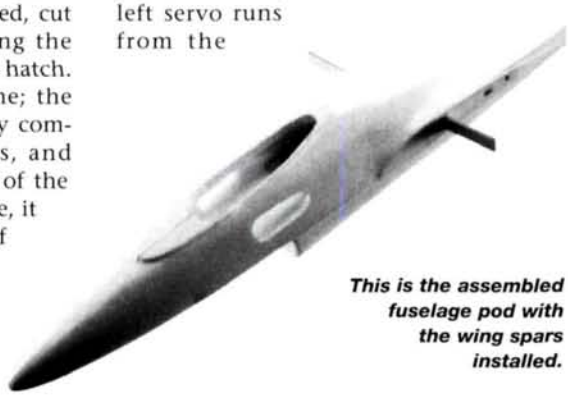
The left and right horizontal stabilizers have an embossed hinge line to identify the elevator; you remove a portion of the stamping after the stab has been affixed to the fuselage to allow the control surface to move. I found the elevator movement was still a bit stiff, so I gently scored the material above the hinge line, and it then operated freely.

MATERIALS NEEDED

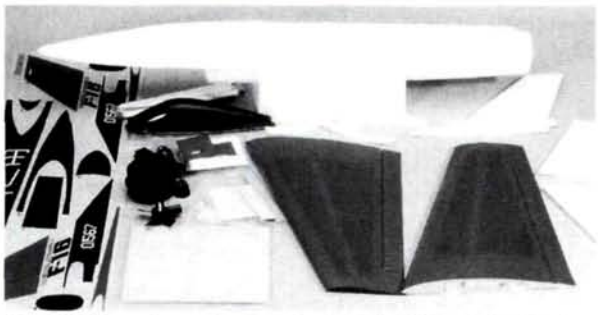
- 3-channel radio.
- 4 miniservos.
- 7-cell, 8.4V battery pack.
- Battery charger.
- 4 servo extensions.
- 2 Y-connectors.
- 30A aircraft speed control.
- Small and medium Phillips screwdrivers.
- No.11 blades and hobby knife.
- Drill.
- 30-minute epoxy.
- Foam-safe CA.
- Sandpaper.
- Scissors for canopy and decals.
- Adjustable wrench.
- Clear tape.

RADIO AND LINKAGES

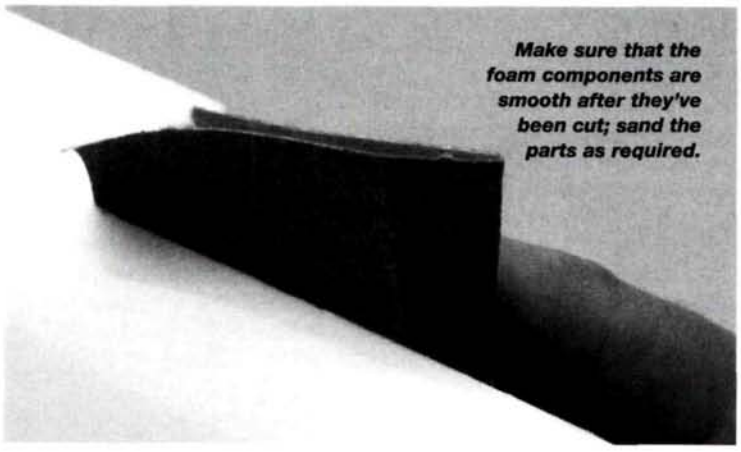
Your choice of radio system will play a key role here. The instructions are written with the assumption that you're using a standard 4-channel radio. To accommodate the dual elevator servos, the left servo runs from the bottom of the servo output arm and the right side from the top of the arm. There's a minor bend in the pushrod to clear the stab. To get around this slightly awkward setup, I used a programmable radio with V-tail mixing that enabled me to run the



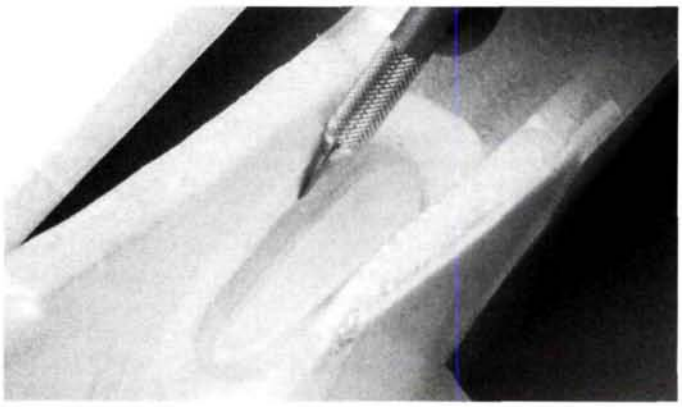
This is the assembled fuselage pod with the wing spars installed.



The F-16 has a foam structure laminated with hard plastic; the kit includes a fan, a motor, hardware and detailed graphics.



Make sure that the foam components are smooth after they've been cut; sand the parts as required.



The easiest way to ensure clean and precise cuts is to cut the foam components from the inside of the fuselage.

pushrods with straight linkages.

I thought the stock pushrods could have been a bit stiffer, but they work fine with the stock setup. If you upgrade to a more powerful motor, I suggest you change to a stiffer pushrod.

The instructions recommend double-sided tape to mount the servos. I used the new Hitec* HS-85 MG servos that come with nifty little mounts that allowed me to screw the servos into place in the conventional manner.

Remember that there's only a short wing spar on the plane; make certain that the area where the wing root attaches to the fuselage is roughed up to offer the best epoxy bond.

The CG location is very narrow (100 to 103mm). I found that once everything had been assembled, the only adjustment required was to shift the battery pack.

I fly my F-16 using either a 7- or 8-cell 2000mAh battery pack. Performance is much better with the 8-cell pack, and flight times average about 4½ minutes. This may

The electric ducted fan in the F-16 is the same powerplant as Kyosho's "Model of the Year"-winning T-33.

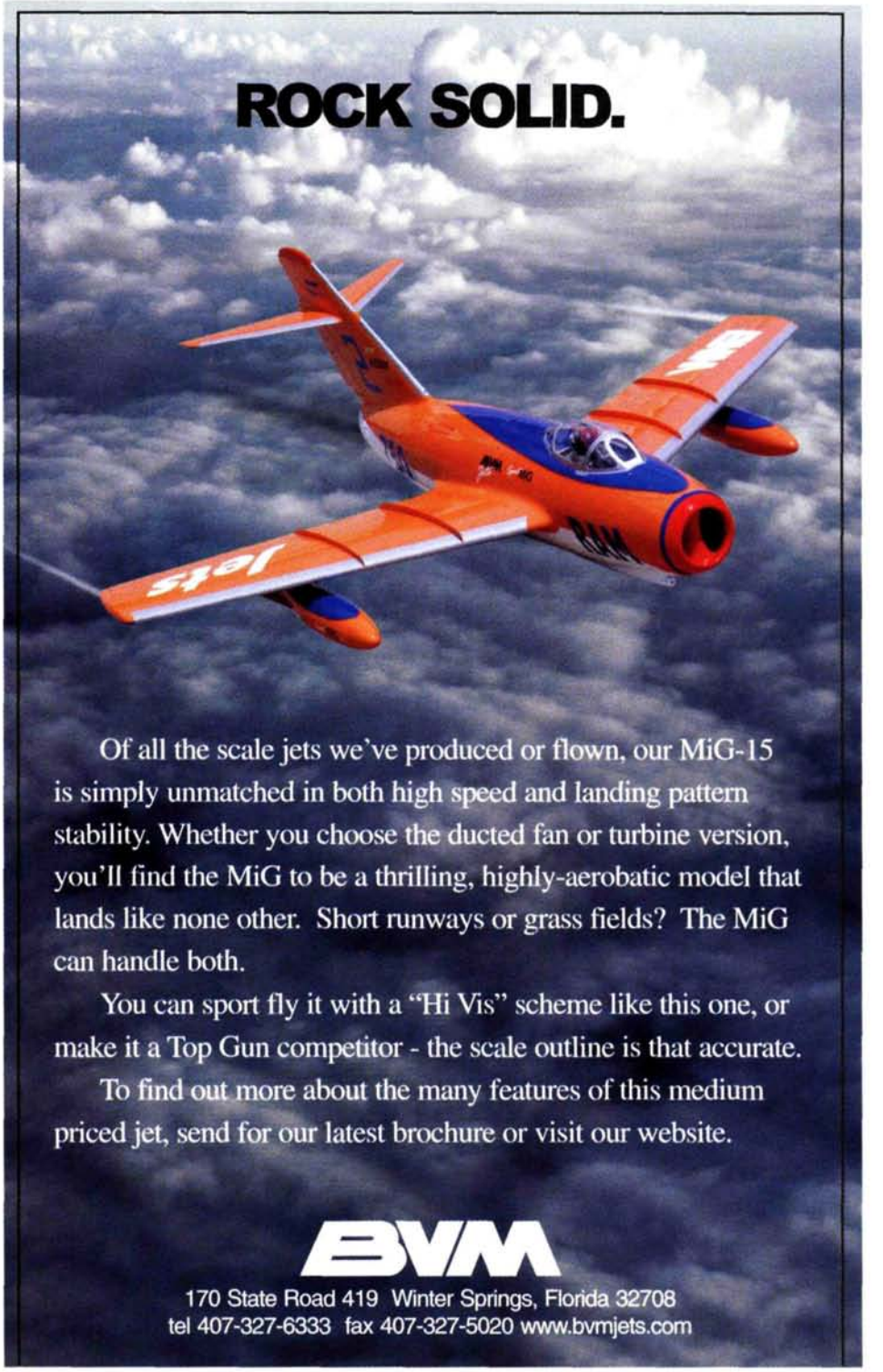
seem brief, but it includes plenty of low-altitude, wide-open-throttle, high-speed passes. Most fliers who burn gas only get about 5 minutes of flight, anyway. The F-16 flies well—but not great—on the 7-cell; I have even seen it flown with just 6 cells.

The access cover on the bottom of the plane can be left off when you fly and used as a cheater hole to get more air into the fan. I have decided to fly with the access hole covered, since the extra drag created when it's open seems to counter the effect of getting more air to the fan.

When my flying buddies see me grab the plane to fly, they yell "Turn on the Hoover!" The F-16 does sound like a flying vacuum cleaner, and, as a matter of fact, I have used it to blow out the dust from the garage and a few leaves off the sidewalk!

I really enjoy flying my Kyosho F-16; the high quality of the kit makes building easy and quick, and the plane flies well. If you want to try electrics or a ducted-fan model, the F-16 is an excellent choice. It's certainly worth the price.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 134.* ✦



MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

by Randy Randolph

HERR ENGINEERING

P-51 Mustang

The P-51 Mustang is one of the world's most modeled airplanes, and over the years, we've seen many Mustang kits; some sacrificed scale appearance for good flight characteristics, and others forfeited performance in favor of scale fidelity. You will be more than happy with Herr Engineering's* sport-scale version of this popular warbird: it looks good; its tab-and-notch construction make it easy to build; its semisymmetrical wing ensures that it flies well; and it isn't expensive. If you decide to power it with a Norvel* Big Mig .061 RC engine, you'll stay well within your budget.

Quick-build ½A warbird

FIRST IMPRESSIONS

All of the parts are sealed in individual, clear-plastic bags, and the rest of the box is filled by two rolled sheets of CAD-drawn plans, an instruction booklet, military markings stickers and a carefully wrapped clear canopy. The laser cutting is precise, and the wood's density is generally well-matched to each part and should be strong enough for its purpose. Hardware includes landing gear, aileron torque rods with clevises and tailwheel wire. Pushrods and linkages to rudder, elevator and throttle are not included, so you must use your own discretion in these areas.

First, label all of the laser-cut parts while they are still tenuously attached to their sheets. The laser cutting has been so well done that most of the parts readily fall out of the sheets and can be difficult to identify.

CONSTRUCTION

Start with the tail surfaces. Epoxy the fin and rudder, then join the elevators with the provided ⅛-inch-diameter hardwood dowel. When the epoxy has set, temporarily join the movable surfaces to their fixed counterparts, and sand them to blend with each other.

At this point, I strayed from the instructions, which said I should bend and glue the tailwheel to the bottom of the rudder. I've never been happy relying on rudder hinges to support the tailwheel during the shock of landing; I much prefer to use a bracket to absorb shock and a tiller attached to the rudder for steering.

SPECIFICATIONS

Model: P-51 Mustang

Type: ½A sport-scale kit

Manufacturer: Herr Engineering

Wingspan: 42 in.

Wing area: 303 sq. in.

Weight: 22 oz. (27 oz. as built, w/servos of standard size)

Wing loading at 22 oz.: 10.5 oz./sq. ft.

Radio req'd: 4-channel (throttle, elevator, rudder, aileron) w/standard or miniservos

Engine req'd: .049 to .074

Engine used: Norvel Big Mig .061

Price: $62.95

Features: laser-cut wooden parts; rolled, CAD-drawn plan; clear formed canopy; landing gear; aileron torque rods and clevises; tailwheel wire; instruction manual.

Comments: this excellent kit is fun to build, and the finished model flies well.

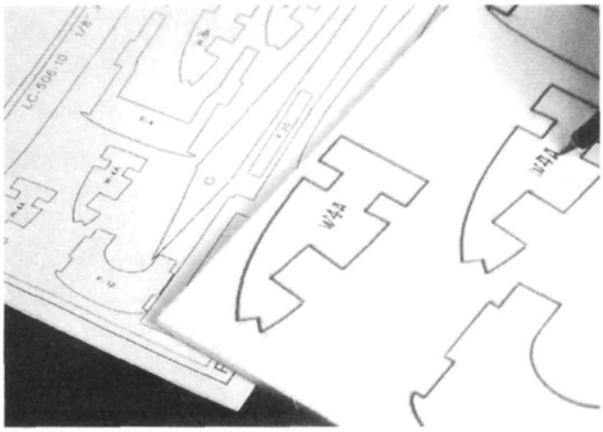
Hits

- Well-engineered, laser-cut parts.
- Good wood selection.
- Logical construction sequence.
- Easy to fly and looks scale.

Misses

- It would have been nice if the soft wooden blocks that form part of the fuselage had been preshaped.

Each fuselage side is made of two pieces that have to be glued together; then, to complete the sides, glue a plywood doubler to the inside of each. All of the parts fit very well, and when I had finished the sides and joined them with the bulkheads, the fit was perfectly smooth! Herr Engineering's secret is to use right triangles to position the first two bulkheads accurately in their notches on the first fuselage side.



With most laser-cut kits, the first step is to label the parts using the instruction sheet as a guide. A felt-tip pen works great for this.

Because I intended to use the JK Aerotech* Slick Mount, which includes the fuel tank, I drilled the firewall to accept that mount as well as the throttle line before I installed the firewall in the fuselage. I actually installed two throttle lines—one on each side of the mount—so that I'd be able to use an engine with a throttle arm on either side.

When building the fuselage, my only deviation from the instructions was to plank the forward turtle deck. It had been a long time since I had done any planking, and I just wanted to do a little because I think it's fun. Following the instructions would have been faster; sheeting the aft deck went a lot more quickly. Wetting the sheet and forming it around a 2-inch cylinder to dry made the aft sheeting a breeze to deal with.

To finish the fuselage, you have to carve and shape two blocks in front of the wing on the bottom of the fuselage, two blocks that fair the fin into the fuselage and stab, and two long triangular blocks that finish the cockpit area. With a sharp knife and then 80- and 100-grit sandpaper, I rough-shaped everything. When I had finished shaping the blocks, the canopy fit perfectly.

For the fin/stab/fuselage fairing, I spot-glued balsa scrap where the fin and stab would later be attached, spot-glued the fairing blocks into place and then carved and sanded them to shape. When I had finished, I cut the fairing blocks off the fuselage and put them aside to use later when I added the fin and stab to the fuselage.

The wing is built over the plan. The bottom main spar is pinned into position with a strip of 1/8-inch-square balsa as a spacer between it and the building board. The ribs have an extension on the bottom trailing edge that holds them at just the right angle to match the spar and be secured to the board. The top spar, spar webs, leading and trailing edges and top center sheeting are added while each wing half is still on the building board. When you've finished the wing halves, lift them off the board and glue the landing-gear mounts into place before you complete the bottom sheeting.

The hardwood landing-gear mounts must be drilled with a 3/32-inch bit to accept the landing gear. Because these holes and the grooves that are machined into the mounts will be under the bottom leading-edge sheeting when the sheeting has been installed, it's easier to drill the holes on the sheeting before you install it. I did this by putting a short piece of 3/32-inch wire into each hole, fitting the bottom sheeting against the leading edge and pressing the sheeting against the wire in

FLIGHT PERFORMANCE

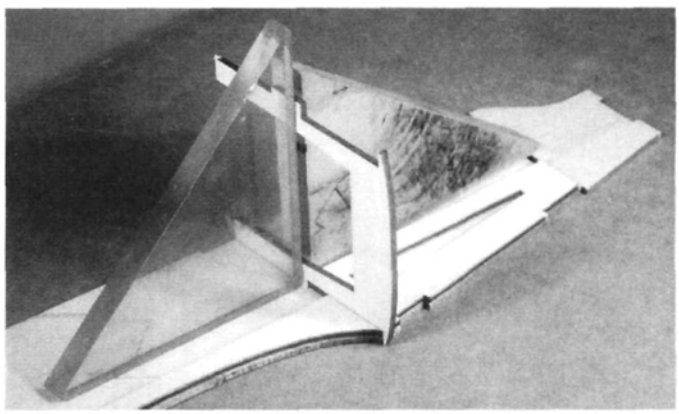
• TAKEOFF AND LANDING
The first flights were made in a 15- to 20-knot wind that blew directly across the runway. I couldn't take off into the wind, so a crosswind takeoff was my only option. There was enough rudder power to keep the airplane going straight down the runway, and a quick crab kept the climb-out straight.

Landings do not require any power, and the airplane, which is very clean, tends to float when landing. The glide is fairly fast and flat, and you need to give that some thought when setting up for landing. The landing gear is properly placed, and wheel landings and stall landings look great!

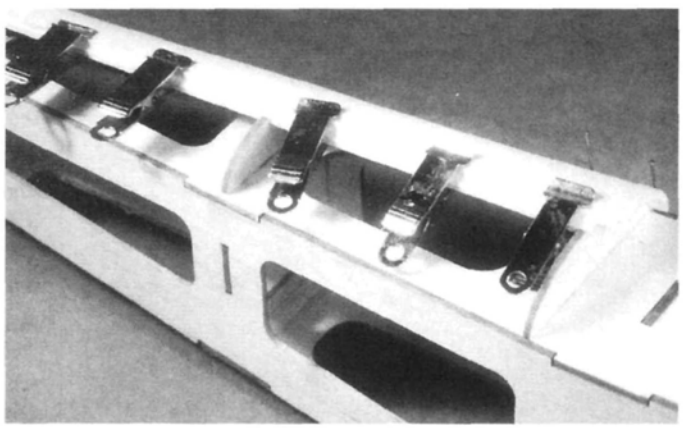
• GENERAL FLIGHT CHARACTERISTICS
Slow flight is not as slow as with a trainer, but the airplane can be kept in the air with very little throttle. When flying slowly, rudder control should be applied gently, or the airplane will snap. And speed should be kept up when you're landing to avoid snapping over the top (into the down-aileron) when the model turns toward the runway on final approach.

• AEROBATICS
This P-51 is responsive; it grooves like a little pattern airplane and will do just about every pattern maneuver. Loops are nice and round; snaps and spins are tight; and rolls are as fast as you want to make them. Inverted flight and outside maneuvers are not the best, but they can be done. Vertical performance is limited and could be improved by upping the power to a .074 or .10 engine or lowering the weight to the 22 ounces suggested.

The color scheme I chose is not the best; the airplane tends to disappear into both blue and gray skies! Bright colors would be a lot better!



It is important that the two cabin formers be perpendicular to the fuselage sides. Right triangles keep the formers true and vertical while the glue sets.



Clips or clothespins are a great help for holding the aft turtle-deck sheet in place on the center stringer. When one side is secure, masking tape will hold the other side to complete the job.

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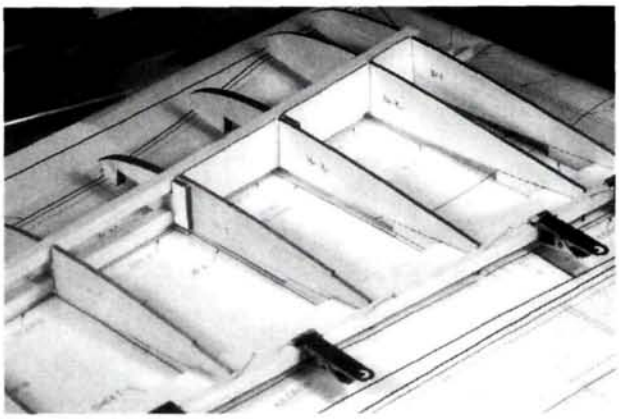


The tabs on the ribs' bottom trailing edge hold them at the proper height from the plan, so the laser-cut trailing edges can be properly positioned.

the holes. I then removed the wires and drilled the holes in the sheeting. This worked great!

I am always amazed at the fit of Herr's laser-cut parts. The leading-edge sheeting is perfectly cut to shape and, installed according to the instructions, it fits every rib and matches the leading edges on the top and bottom perfectly!

Having completed both wing halves, sand the inboard trailing edges, the spars and the leading edges flush with the center ribs, which are canted at the proper dihedral angle. Then epoxy the wing halves together at the center and reinforce the joint with a strip of nylon tape.

After you've installed the aileron hardware, the ailerons themselves require a little work: their inboard ends must be grooved and drilled to match the hardware. Temporarily mount them with masking tape so that you can sand the balsa blocks that form the wingtips to the proper shape. I first traced the pattern of the tip rib on each block and then used a band saw to rough-shape them. I used a razor knife to cut out the servo well in the wing center section and a razor saw to provide clearance for the servos in the two center ribs.

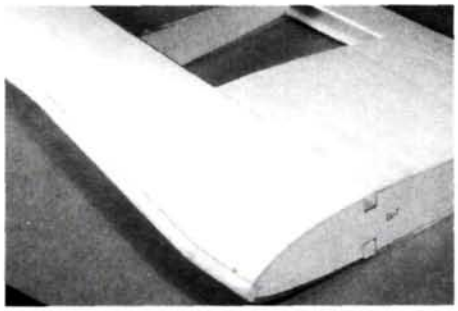
FINISHING UP

At this point, I usually assemble the airplane to see what the bare bones look like. When they look good, as in this case, I am eager to move on to covering. I covered this airplane with light gray and dark blue MonoKote*.

Because it seems to go more easily, I always cover the stab and fin and hinge the rudder and elevators before joining them to the fuselage. Also, mounting the control horns onto these surfaces is easier to do before the fuselage gets in the way! Of course, before you glue them together, you'll need to trim all of the covering material away from the areas that will contact the fuselage. Before I attached the canopy to the fuselage, I painted the cockpit area and engine compartment black.

The gear-leg torque anchors must be bent so that the legs are angled forward properly. Do this before you attach the gear fairings. I covered the fairings and then trimmed away the covering from the area where the gear legs are attached. I used a few right triangles as jigs to be sure the legs and fairings were positioned properly as the epoxy set. I ironed strips of MonoKote over the gear legs to complete the job. After I had installed the gear on the wing, I ironed strips of Mono-Kote over the mounts to improve the appearance of the installation.

There is plenty of room in the fuselage for standard servos, and the area under the tank will easily hold a 500mAh battery pack. I mounted the servos in a plywood servo tray and, after I had mounted the Big Mig .061 in the Slick Mount, I moved the servos to achieve the proper balance and then attached them. I used florist wire through Nyrod for the throttle line and 0.047-inch-diameter music wire



The leading-edge sheeting for the top and bottom of the wings has been laser-cut to match the wing's shape perfectly. These sheets are a perfect fit.

to make the pushrods that go to the rudder and elevator. A guide aft of the cockpit area eliminates any chance of the pushrods bending when they are under compression.

The addition of light wheels completes the airplane, which weighed in at 27 ounces—heavier than the stated weight on the box (22 ounces).

BUILDER'S THOUGHTS

It's easy to see that Tom Herr is a modeler by the kits his company produces. Like his other models, the P-51 is intended to be built, flown and enjoyed. The fun starts as soon as the plan is unrolled and continues through each step of construction and then to the field, where the P-51 proves that it's a great flying little warbird.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 134.* ✦

The only scale accessories needed to complete the illusion are a WW I pilot figure and a William Bros. Spandau machine gun. Note the flying wires and cabane struts; they're only cosmetic.

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

by Rick Bell

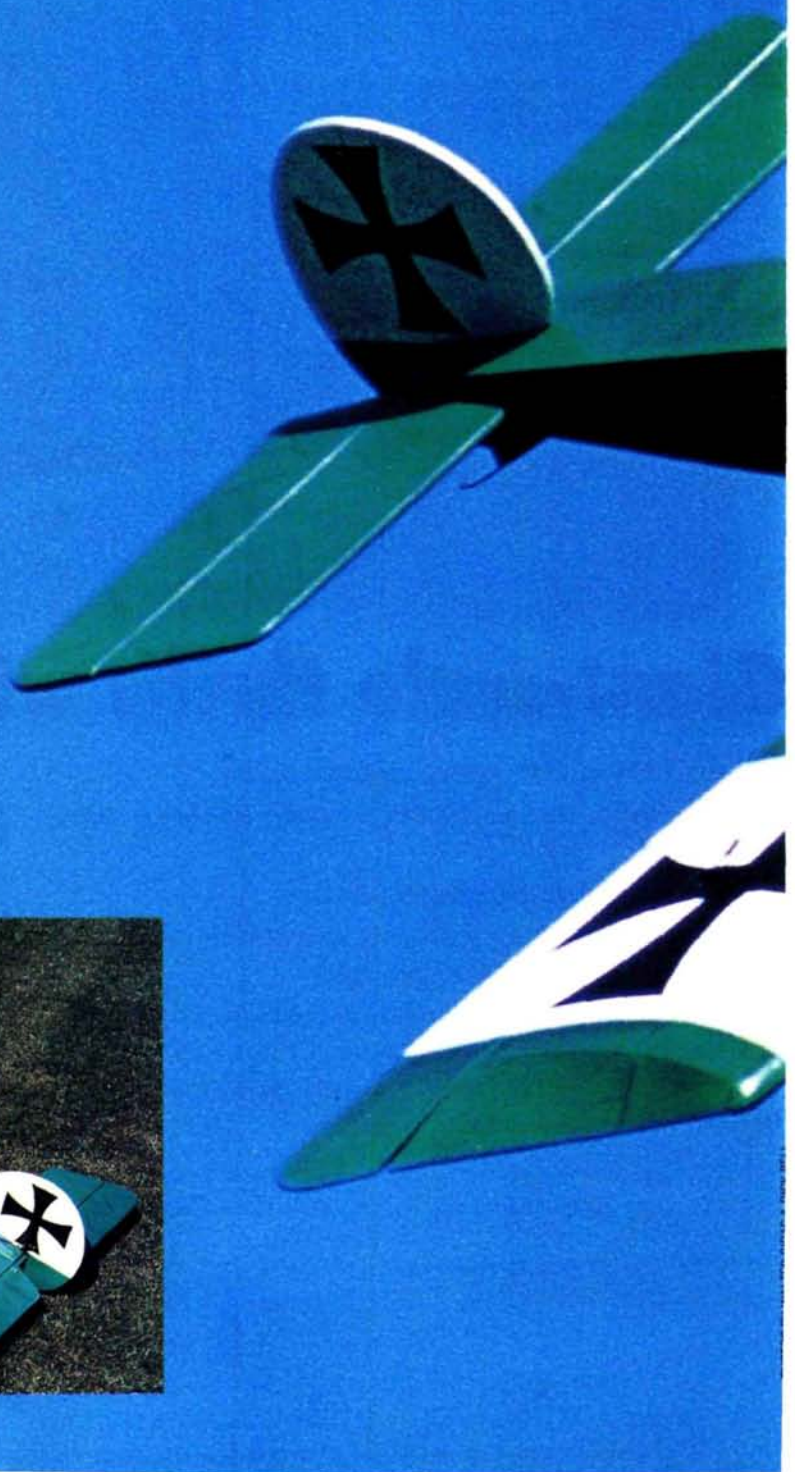
Balsa USA Fokker E.III Eindecker

The scourge of WW I in IMAA-legal form

According to factory records, 268 German Fokker Eindecker E.IIIs were built between 1915 and 1916. Britain was not very pleased about this because nothing in its inventory at that time could match the Eindecker's performance, so they called it the "Fokker Scourge." The Balsa USA* giant-scale Eindecker is a great way to get into an IMAA-legal, WW I plane with little effort.

Because it has only one wing to build and cover, the Eindecker is very attractive to the sport-scale modeler. To simplify construction and enhance the model's flight characteristics, Balsa USA has taken some liberties with the design. Instead of wing warping as on the original, ailerons have been designed into the wing. Conventional tail surfaces are also used, so the kit is easier to build.

Given the size of the finished Eindecker, it comes in a rather small, well-packed box. The kit features good die-cutting and a very well-detailed instruction manual that's packed with a lot of construction photos. The hardware package contains nuts, screws, hinges, control horns and prebent landing gear. The two-sheet plan comes rolled and is highly detailed but easy to understand.



SPECIFICATIONS

Model: Fokker E.III Eindecker

Manufacturer: Balsa USA

Type: sport-scale WW I kit

Wingspan: 80 in.

Wing area: 1,155 sq. in.

Weight: 9.5 lb. (with added nose weight)

Engine req'd: .46 to .61 2-stroke, .61 to .91 4-stroke or Zenoah G-23

Engine used: Saito .91

Radio req'd: 4-channel (throttle, rudder, aileron, elevator) with 5 servos

Price: $129.95

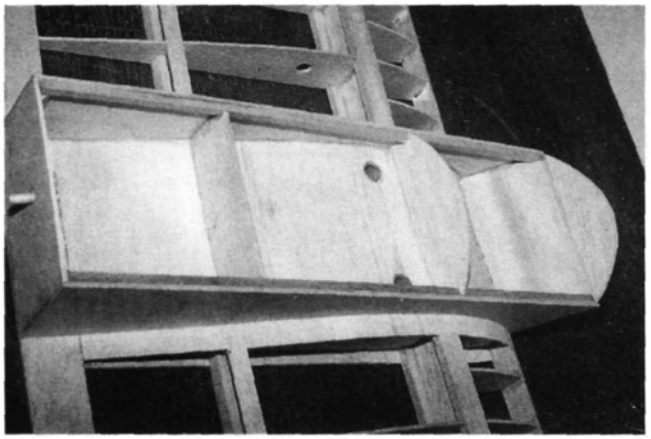
Comments: the Balsa USA Eindecker is a fine sport-scale, IMAA-legal WW I model that's easy to build and a joy to fly. It builds quickly without a lot of fuss. Scale details are easily added to dress up the model. Scale flying draws many positive comments from modelers and spectators. Only build this model if you're prepared to be the center of attention at your club field!

Hits

- Easy to build.
- Good-quality wood and hardware.
- Looks great!
- Great flying qualities.
- Nice spectator appeal.

Misses

- No Maltese-Cross decals provided.
- Tail-heavy, as built.



The cockpit section of the fuselage is a separate piece that's glued to the top of the wing. Note the holes for the wing hold-down bolts.

FUSELAGE CONSTRUCTION

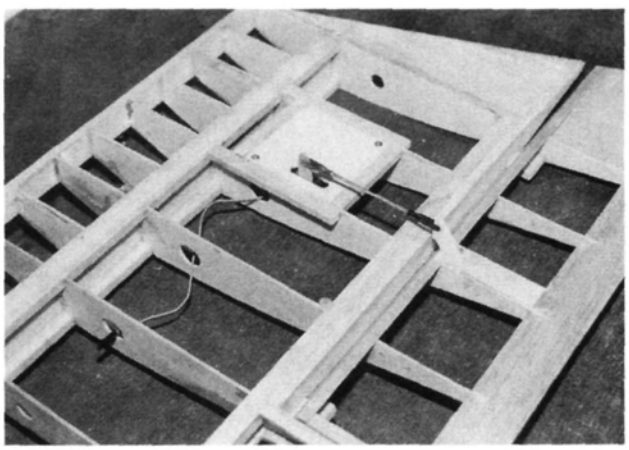
The fuselage, which is basically a box with internal longerons, is built first and goes quickly. I first glued the die-cut ⅛-inch balsa front and rear fuselage sides together directly over the plan. This was followed by ⅛-inch lite-ply doublers. I then mated both sides and sanded them so that they were identical. Next, I added the upper and lower balsa longerons to the fuselage sides, followed by ¼-inch-square vertical stiffeners, thus making a frame inside the fuselage sides. I pinned the right side of the fuselage vertically to the plan and propped it up at the tail with the provided balsa block and formers F-5 and F-8, then I used a square to ensure that everything was vertical. I then pinned the left side to the plan, squared it up and glued it to the formers. After adding the firewall, wing-mount block, upper and lower cross-braces and top sheeting, I removed the fuselage from the plan and flipped it over. Then I installed the landing-gear blocks, the bracing for the firewall and landing gear and the bottom sheeting from the landing-gear blocks forward to the nose (the rest of the bottom sheeting is left off until the pushrods have been installed).

WING ASSEMBLY

Wing construction is easy: it features an interlocking I-beam main spar, grooved upper and lower main spars and a full-span, die-cut "egg-crate" shear web. I first pinned the lower spar into place with the groove facing upward. A slot on one end of the spar should face the center of the wing. Next, the die-cut trailing edge (TE) is pinned into place, using a few ribs for alignment, followed by the rear spar cap. The rear spar is then aligned on the cap, again using a few ribs. The 3/32-inch, die-cut shear web is now placed in the groove in the main spar (be sure it's fully seated), followed by the ribs and the aileron spar, which must be cut to shape before it's pinned into place. The rear upper spar is now glued into place along with the ribs and the TE. I now fitted the upper main spar to the shear web and ribs. When I was satisfied with the fit, I glued everything. Because I wanted to add rigging later, I glued ⅜-inch-diameter dowels vertically at the rigging hard points. I glued the beveled leading edge (LE) to the ribs with the bevel flush with the tops of the ribs, then I added the false ribs between the main spar and the LE. The aileron ribs and the beveled aileron LE are now glued into place. The ailerons are built as part of the wing and are cut free after final shaping; they are also top-hinged, so you do not need to sand a V to the LE.

Now add the TE sheeting, and be sure to leave excess overhang at the wingtip. Then add the rear wingtip to the aileron. It must be tapered at the TE to fit under the TE sheeting and propped up 3/16 inch at the front where it is glued to the aileron LE. I glued the wingtip into place by lining it up with the wing's trailing and leading edges then propping up the LE of the tip before gluing it to the wing. Repeat the construction sequence for the other panel, then join the panels. Add the wing-bolt mount and the center-section sheeting to the bottom of the wing. The wing can now be fitted to the fuselage. When I was satisfied with the fit and had made sure it was centered and square to the fuselage, I drilled and tapped the holes for the wing-mount bolts, added the top center-section sheeting and made the holes in the sheeting for the wing bolts.

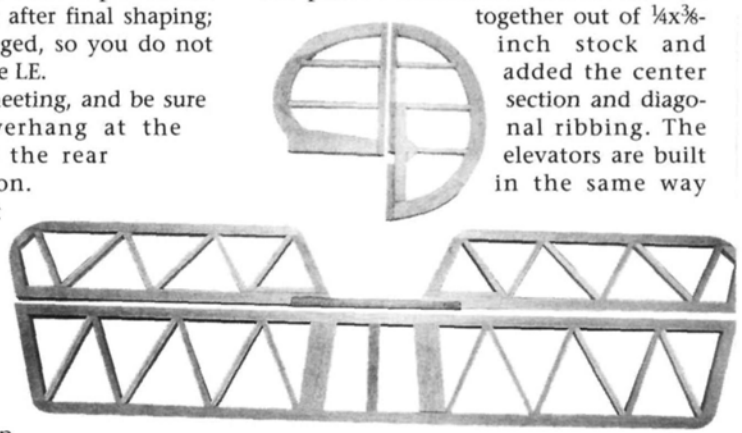
The cockpit area of the fuselage is now built directly on the wing, and the hold-down dowel is also added at this time. I finished this entire assembly really quickly, and the parts fit was excellent. The last things to do to the wing before final shaping and sanding are to build the aileron servo bays, mount the servos and hook up the linkages using the supplied parts. Again, the parts fit was very good.



Unlike the wing-warping full-size Eindecker, the model E.III is equipped with ailerons. The servos are in front of the ailerons, so two are required for roll control.

TAIL FEATHERS

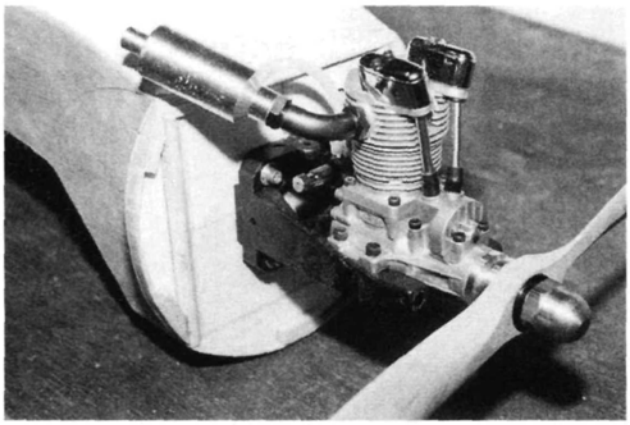
The stabilizer and elevators are built using balsa sticks cut to size directly on the plan. I laminated the LE and TE together out of ¼x⅜-inch stock and added the center section and diagonal ribbing. The elevators are built in the same way and are joined with a ⅜-inch-diameter dowel. For extra security, I pinned the dowel to each elevator half. The rudder and fin are built using die-cut parts that make the outer frame. The construction was the same as a Guillows stick-and-tissue model, only much larger! After building the tail feathers, I hinged them and rounded the edges where necessary.



The tail feathers are built up using balsa stick stock. Note that a hinged rudder is used instead of a scale, one-piece "flying" rudder.

The sub-fin and tailskid assembly were built next. I did make one change here, because the sub-fin supports both the tailskid and the lower hinge of the rudder. Instead of butt-gluing the sub-fin to the bottom of the fuselage, I made it with a tongue that slips into a slot I cut in the bottom of the fuselage. I think this provides much better support for this

high-stress area. The pushrods can now be installed. I used Sullivan* carbon-fiber pushrods because of their strength and temperature stability. Be sure to properly support the pushrods to prevent them from flexing. I now added the bottom sheeting and final-sanded the fuselage. I test-fit the tail feathers and waited to attach them until after I had covered them.



With a Saito .91 4-stroke engine, the E.III has an abundance of power. The engine is mounted in the inverted position.

ENGINE AND RADIO INSTALLATION

The front end is now completed by adding the cheek cowls and assembling and mounting the cowl. The cowl is molded in two pieces of thick ABS. It required very little effort to finish and was an excellent fit to the fuselage. I waited to add the cheek cowls until after I had covered the fuselage.

Now is the time to mount your choice of engine. The instructions recommend that you don't over-power the plane, so I used a Saito* .91. A G-23 would also be a good choice. Because the firewall is wide open, it's easy to install the engine mount and attach the engine.

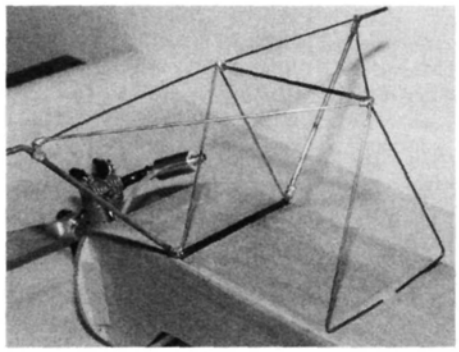
There's plenty of room in the fuselage, and radio installation is straightforward. To minimize the nose weight you'll need later to balance the model, try to keep everything as far forward as possible.

COVERING AND DETAILING

In my opinion, an Eindecker without some type of scale landing gear just doesn't look right. Although Balsa USA does not supply any material to add scale-type landing gear, it does provide instructions and photos that describe how to make the optional gear. This was easy to do, and the scale gear really adds to the charm of the finished model.

Because the full-scale plane is covered with fabric, I decided to cover the Eindecker with Coverite* Super Shrink and paint it with Stits*. This was my first experience with Stits paints, and I thought they were very easy to use; the results were excellent. I also painted the Maltese Crosses on the model (the kit doesn't include decals).

With painting and covering complete, I then glued the tail feathers into place, added the hinges, remounted the radio gear and engine and added the scale details. I used floating fly-fishing line for the rigging.



The only really difficult part of the model is binding and soldering the scale main landing gear. As you can see, it is very scale-like in appearance.

Because of the model's short nose moment and light engine, I needed to add almost 1½ pounds of lead to the nose to achieve proper balance. The good news was that the airframe weighed only 8 pounds, so the overall weight was 9½ pounds—not bad, considering the size of the model! To reduce the need for so much ballast, I think I could have added some open bays to the rear of the fuselage without compromising strength.

BUILDER'S THOUGHTS

The Balsa USA large-scale Eindecker offers a quick and easy way to build an IMAA-legal, sport-scale WW I model. It is easy to fly, looks just great in the air and never fails to draw attention wherever it goes. The extra weight in the nose doesn't distract from the nice flying characteristics of the Eindecker. Overall, it's a great project for the sport-scale modeler.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 134.* ✈

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

Because the Eindecker has a wire skid instead of a tailwheel, I did some taxi tests to learn how to steer the model. Who says you need a tailwheel?! A short burst of power with rudder makes ground handling easy on pavement and grass (and it sounds scale, just the way the engines on full-scale WW I planes cut off and on!).

When the model was lined up on the centerline, I advanced the throttle, and the Eindecker quickly gained speed. Very little rudder input was needed to keep it straight. After a run of about 100 feet, the Eindecker gracefully took to the air. Only about ½ throttle was needed. After a few trim laps to let my nerves settle down, I made some low passes—boy, this plane looks great!

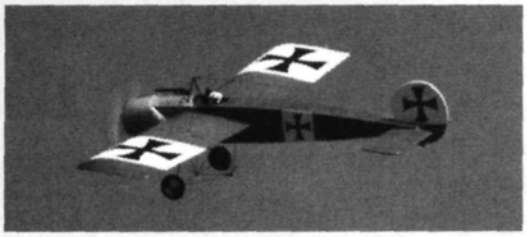
Landing the Eindecker is very uneventful; it's very solid and true all the way down without a tendency to drop a wing. Just be sure to carry some throttle until you flare because the model slows down quickly.

• LOW-SPEED PERFORMANCE

The Eindecker's slow-flight characteristics are very good. In fact, it's a lot of fun to fly the Eindecker slowly. It's very stable and will fly very slowly before stalling, at which point it just mushes forward. The Eindecker's slow flight is like that of a trainer; that huge wing provides a lot of lift.

• HIGH-SPEED FLIGHT AND AEROBATICS

Surprisingly, the Eindecker can really scoot along. Simple, scale maneuvers such as loops, rolls and—of course—Immelmann turns, are easily done. Maneuvers that aren't scale, such as Cuban-8s and inverted flight, are also possible, but very much out of character. Even 4-point rolls can be achieved! The Eindecker's forte, however, is scale flying. As Balsa USA writes in the manual, the model is "an absolute delight to fly."



MODEL AIRPLANE NEWS

CONSTRUCTION

A 1.20-size warbird for the sport flier

P-51 MUSTANG

by Stephen Scotto

OK; let's admit it. Everyone wants to build a P-51. It drips power, courage and heroism. It's an icon of WW II fighters; why shouldn't you build one? That's the question Chris Chianelli asked me, and it's why he proposed this project. A ⅙-scale model yields a 74-inch wingspan—big enough to fly right yet still small enough to transport. The new, larger displacement, 2-stroke glow engines fit this size perfectly.

SPECIFICATIONS

Model: P-51 D Mustang

Type: sport-scale

Wingspan: 74 in.

Wing area: 900 sq. in.

Length: 64.5 in.

Weight: 14 lb.

Wing loading: 36 oz./sq. ft.

Engine req'd: 1.20 to 1.50 4-stroke; 1.50 to 2.10 2-stroke

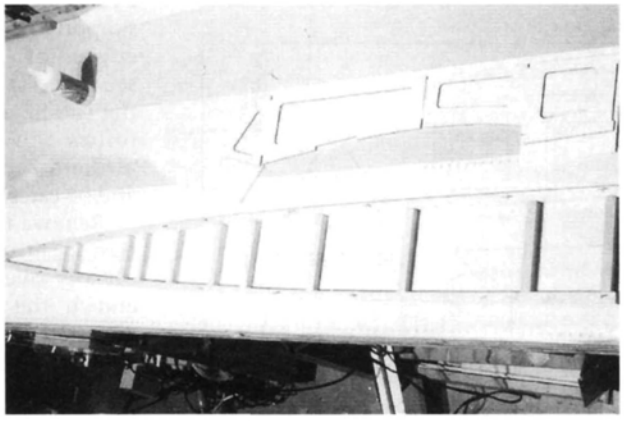
Engine used: Webra 1.20 2-stroke with Slimline Pitts-style muffler

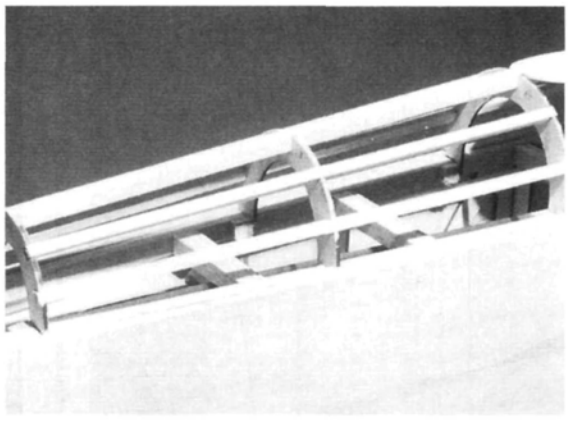
Radio req'd: 4-channel (elevator, throttle, aileron and rudder; flaps, retracts and bomb drop optional)

Radio used: Futaba* 9-VAP

Retracts used: Robart no. 622

Comments: designed by Stephen Scotto, the plan was drawn using ModelCAD and was developed using Lloyd 3-views from Bob Holman*. The model uses traditional built-up construction and employs balsa and plywood throughout. Building tabs are included on the wing ribs, and they ensure the proper amount of washout at the wingtips. Fiberglass cowl and air scoop, formed canopy and drop tanks are available from the author; ordering instructions are on the plan.





Left: the fuselage is built around this longeron framework made from ½-inch-square balsa. Note the lite-ply doubler already attached to the balsa fuselage side. Right: aft of the turtle deck, the stabilizer support pieces have been added and sanded to blend into the fuselage sides. Note that the rudder pushrod tube has already been installed.

THE MODEL

The model is intended to be an attractive and practical airplane that any experienced modeler could build and fly. It has a scale outline, but the fuselage and the wing have been simplified. Standard modeling materials and fittings from normal hobby outlets are used in its construction. To ease wing construction and to produce 2¼ degrees of washout at the tips, I added alignment tabs to the ribs.

The prototype was pulled by the brawny Webra* 1.20 2-stroke engine. Four-stroke fans should use at least a 1.20 engine. The engine is side-mounted, and the cylinder head extends out of the cowl. This allows excellent cooling and provides enough room for a Pitts-style muffler.

The prototype used 10 servos. Fortunately, you don't need the expensive, oversize units. Each flap and aileron is driven by its own servo while the elevator is driven by two servos linked together. The rudder, bomb drop, throttle and retract valve make do with one servo each.

CONSTRUCTION

Start with the stabilizer and vertical fin; they are airfoil-shaped, and to ensure warp-free construction, they use the half-shell construction method. Each half is built flat on the board, then the halves are joined to form the final shape.

Place the fin parts over the wax-paper-covered plans, then add the sub-leading and sub-trailing edges. Add the ribs, and use scrap balsa to form the mass-balance pocket. To eliminate high points, sand the ribs with a 12-inch sanding bar and skin with 1/16-inch balsa. Remove the fin from the board and build the other half (use the mirror image on the plan!). Glue the halves together with aliphatic resin, then add the leading and trailing edges and tip block. The stab is built in the same way: both top and bottom are built over the same drawing.

The rudder is built on a balsa core sheet with half ribs added to both sides. Cut the balsa core to shape and mark the position of the ribs on both sides. Glue the balsa leading edge (LE) and the ribs into place on both sides of the core sheet. Add filler blocks on top and bottom, and rough-sand the rudder to shape. Final-shaping should be done when the fin has been attached to the fuselage. Cut the elevators from solid ½-inch balsa stock, and taper to shape.

WING CONSTRUCTION

First, decide which accessories you want to incorporate in the wing. It can be built with flaps, bomb drop and retractable landing gear; it's your choice. To reinforce the Robart* no. 622 retracts installation, ribs W4 and W5 are built from ⅛-inch lite-ply, with ⅛-inch and ¼-inch aircraft ply doublers. A ¼-inch aircraft ply landing-gear plate provides an extremely secure mount. If you choose to go with fixed gear, use doublers W4F and W5F as shown on the plan.

The wing halves are joined with a four-piece, laminated, ⅛-inch lite-ply brace. Aeroplane Works* cardboard conduits carry the leads to each servo. The flaps are built up with 3/32-inch balsa. If you don't want flaps, do not cut the dotted lines shown on ribs W2 through W7.

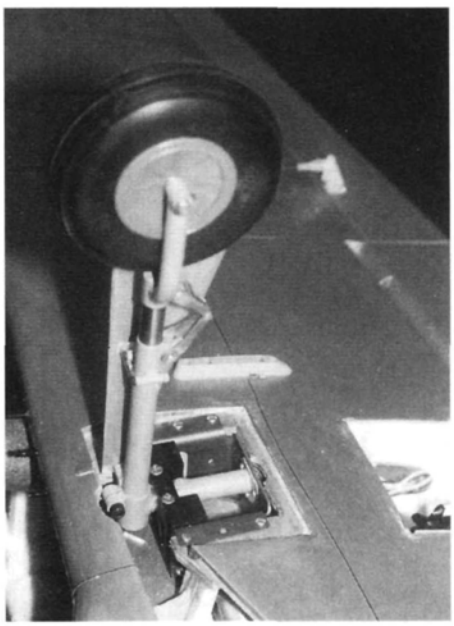
Make the wing skins from 3/32-inch balsa by edge-gluing the sheets together to form four larger sheets that are approximately 14 inches wide. Sand the joint lines flush, then roughly shape the four sheeting pieces. The separation line for the sheets should be over the centerline of the spar.

Build the wing upside-down over the plan. Attach the landing gear and servo doublers to ribs W4, W5 and W8. Drill the mounting holes for the servos now; it will be much easier than when the wing has been completed. Pin the bottom main spar to the board, and set rib W1 aside until later. Pin ribs W2 through W11 into place, and make sure that each rib is square to the building board. Install the servo conduits as shown on the plans, then use thin Zap* to secure the ribs to the main spar. Do not glue rib W1 into place yet!

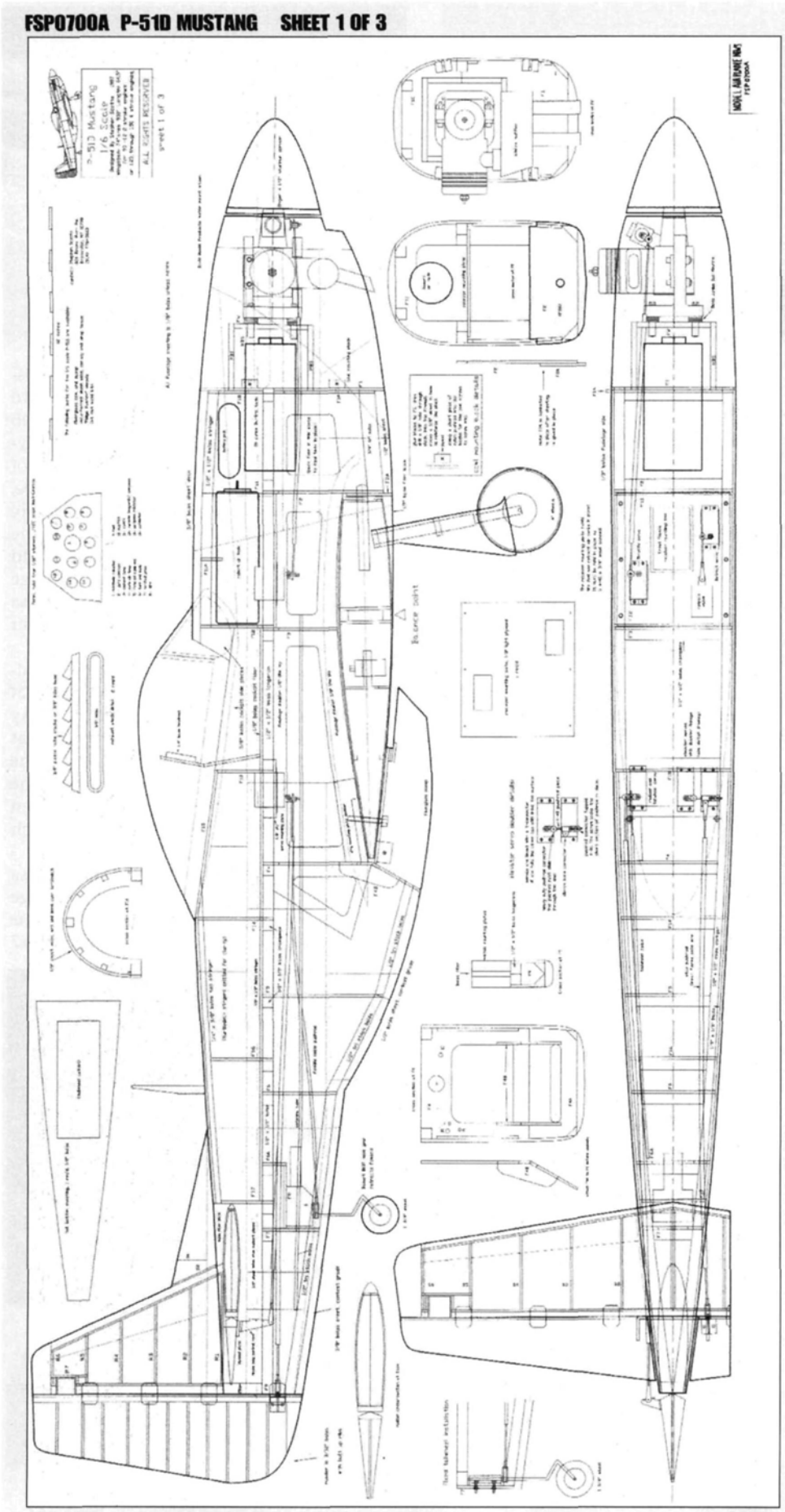
Install the top main spar in the rib notch, make sure that it overhangs the root rib and Zap it into place. Glue the ⅛-inch lite-ply center-section webs into place on both sides of the spars. Pin rib W1 into place, using the angle of the plywood webbing to set the dihedral tilt of the root rib. To help set the rib in place, put bulkheads W12 and W16 in the notches. When you are satisfied with the fit, glue everything into place and add W15. Glue the 3/32-inch sub-leading-edge pieces into place, and use 3/32-inch balsa sheet to make the vertical-grain shear webbing between the ribs.

To make it fit under the skin, the landing-gear plate must be beveled slightly at the main spar; after checking its fit, epoxy the plate into place. After the epoxy has cured, drill an ⅛-inch hole through the landing-gear plate about 1 inch into the W4A rib doubler, exactly where shown on the plan. Epoxy a piece of ⅛-inch dowel into this hole.

Cut and glue a 3/16-inch-square balsa spar into the notches at the trailing edge (TE) of ribs W2 through W7. Do the same with a 3/32x3/16-inch stick between ribs W7



The Mustang is designed for retracts, but you can build it with fixed gear. Here, the Robart gear have been bolted into place. Access for maintenance is easy.



and W11 and the ¼x⅜-inch spars that support the bomb drop and form the edges of the aileron and flap servo-access hatches. Shape and sand the sub-LE and TE pieces to smoothly follow the contour of the ribs. Use medium Zap to attach the wing skins, and be careful not to distort the wing.

Remove the wing from the building board, cut off the building tabs, sand off any overhanging wing sheeting, and cut the access holes for the aileron and flap servos. Pin the wing to the work table, right side up, and sand the sub-LE flush with the ribs. Drill a hole through the webbing between ribs W4 and W5 to pass the air lines from the retracts into the conduit.

Fit W14 into place next to rib 1. Glue scrap balsa into the TE between ribs W1 and W2, and sheet the top of the wing. Glue the LE into place, and sand it to shape. Add the ¼-inch sheet TEs, and make sure that the flap hinge-support blocks are in place before you glue it to the wing. Add the wingtip block, and sand it to shape.

Build the other wing half in the same way, then laminate the four center-section brace pieces with medium Zap. Cut rib W1 to form a slot between the spars, and trial-fit the brace into place. Epoxy it into place in both wing halves with 2⅝ inches under each wingtip. To ensure a straight wing, make sure that the TEs line up with each other.

Epoxy W17 in the wing center section, and make sure that the ½-inch hole lines up with the slot in rib W1. Reinforce the center section with 6-inch fiberglass or nylon tape. Drill a ½-inch hole at least 3 inches into the wing, keeping the drill bit as square to it as you can. Zap a ½-inch dowel into place, and leave about ½ inch protruding.

Pin the 3/32-inch balsa flap skins over the plan, and mark the location of the ribs. Zap the 3/16-inch-square balsa spar on top of the sheeting at the LE, and then Zap the flap ribs into place. Glue the top spar into place, then glue the sub-LE into place. Add the hinge support blocks and, to provide a base for the flap control horn, make sure the oversize center block fits between ribs FL3 and FL4. Add the top sheeting, then mark the flap's sub-LE centerline and drill holes for the Great Planes* Pivot Point hinges. Add the ½-inch LE, leaving notches for the hinges, and sand the LE to shape (see detailed drawing on plan).

Using the hinges as a guide, mark the wing's TE centerline and drill 5/32-inch holes for the flap hinges. Epoxy a 1-inch-long piece of brass tube into each hole, and allow the tubes to protrude from the holes about 3/16 inch.

FLIGHT PERFORMANCE

I looked at a lot of P-51s before I flew this bird. Mustangs are big and solid, and they fly with authority. They were designed to be stable, solid gun platforms. They fly straight and make big loops and rolls; fly this model the same way. Don't try to snap and spin it like an Extra; it will just look silly.

• TAKEOFF

This is one of the true delights of flying the model. It's stable, and it tracks rock-solid when you treat it right. Be sure you know how to fly a tail-dragger before you attempt to fly this one. The nose is way up in the air when the Mustang sits on its tall landing-gear struts, and this plane needs careful attention at the beginning of the takeoff roll.

Begin the takeoff roll with a small amount of right rudder and full up-elevator. To avoid nosing over, gently apply throttle, and ease off the up-elevator as the model gains speed. There shouldn't be any up-elevator left when the tailwheel lifts off. Let the plane fly off the ground using minimal elevator for liftoff. Hold right rudder to climb out, and allow the plane to accelerate as it climbs. To avoid distraction, pull up the landing gear after you have made your trims and leveled the plane out.

• GENERAL FLIGHT CHARACTERISTICS

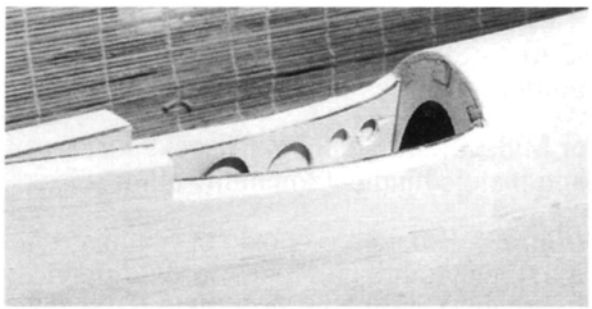
Reduce power to about ¾ throttle for level flight. The big Webra pulls this plane with authority. Loops are a delight to watch, but remember to reduce power on the downside of the loop. Rolls are majestic; make sure you have plenty of speed on entry.

If you lose the engine in flight, get the nose down and get back to the runway. Don't worry about the landing gear until you are sure you have made the field. It's better to scratch the bottom of the model than to lose it while you fiddle with the switch.

• LANDING

For your first landing, leave the flaps up. Remember to drop the gear then turn gently onto final and carry some power until you have the field made. Cut the throttle as you cross the runway threshold. The plane will run on the mains before settling down. Remember to steer with the rudder on the ground! As you gain more confidence with the plane, you can experiment with the flaps.

This model requires experience to fly but rewards careful technique. It looks and sounds realistic in the air, and it's a pleasure to fly.



Aft of the turtle deck, the stabilizer support pieces have been added and sanded to blend into the fuselage sides.

Test-fit the flap and hinge parts before you epoxy everything into place. The tubes' extensions are necessary to stiffen the hinges. Add the ¼-inch triangular fairing strip to the top of the TE, and sand smooth.

Cut the ailerons from ¾-inch balsa stock, tack-glue each into place, and shape with a plane and sandpaper. If you install retracts, make a cardboard wheel-well template, and cut open the bottom of the wing to install them. Line the wheel wells with 1/16-inch balsa. Fit the retracts into place, and make sure that they operate properly.

FUSELAGE

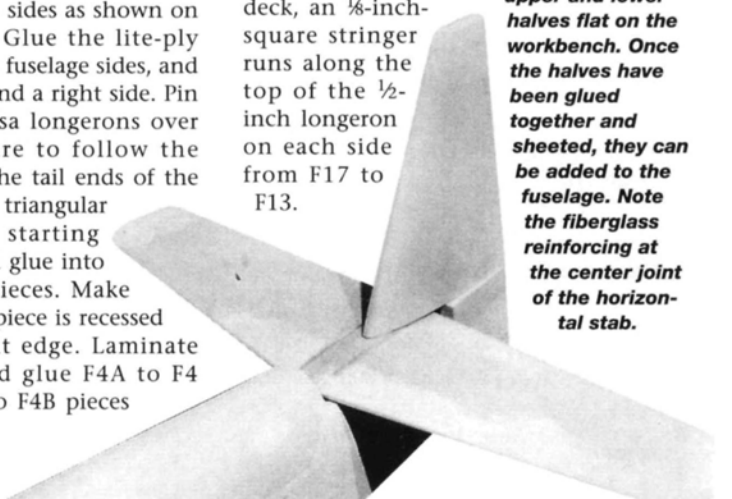
The fuselage uses ½-inch-square longerons to provide mounting points for the formers, and the nose is shaped from ½-inch balsa sheet sanded to shape.

Edge-glue ⅛x48-inch-long balsa sheets together, and cut out the two sides as shown on the plans. Glue the lite-ply fuselage doublers to the fuselage sides, and be sure to make a left and a right side. Pin the ½-inch-square balsa longerons over the plan, making sure to follow the fuselage outline. Join the tail ends of the longerons with a small, triangular piece of balsa, then, starting from the front, cut and glue into place the balsa crosspieces. Make sure that the first crosspiece is recessed ¼ inch from the front edge. Laminate former F2A to F2 and glue F4A to F4 together, using the two F4B pieces to brace them and to set the angle shown on the plan. Glue formers F2, F5, F6, F6A, F7 and F8 to the balsa crosspieces, and make certain that they are square to the longeron frame. Glue F9 to the top of the stringers at the tail.

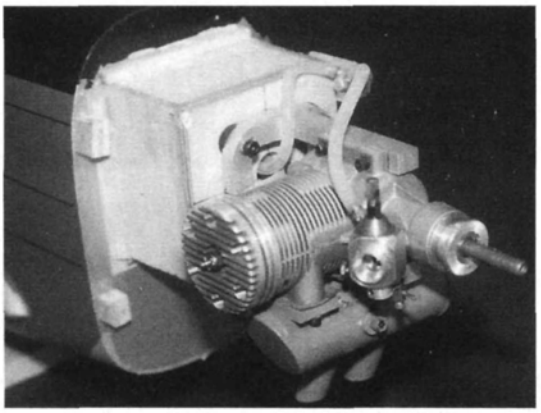
Using former F2 as a guide, pin (don't glue) both fuselage sides to the longerons. Make sure the tabs on F2 fit into the slots in the doubler. The balsa sides may have to be trimmed slightly so the ply doubler fits snugly on top of the longerons. Without gluing, put formers F1, F3 and F4 into place, and use the pins to hold the sides against the longerons. When you are satisfied with the fit of the formers to the fuselage sides and doublers, glue the sides into place with thin Zap. Use thick Zap to secure each former to the fuselage sides and to the balsa crosspieces. Remove most of the pins holding the longerons to your work table, then place the antenna tube and pushrod sleeves through the holes cut in the formers. Glue tailwheel plate F8 to former F7 and F6A. Use balsa tri-stock to brace the plate to the fuselage sides, and fit the tailwheel unit into place. It can be left in place for the rest of construction.

Cut and glue into place the ½-inch balsa tri-stock that runs along the bottom of the fuselage from F4 to F9. It should fit snugly against the notches in the formers and should bend to match the shape of the sides. Glue into place the ⅜-inch-sheet rear-fuselage bottom, and cut away the tailwheel opening. Do not round the corners of the fuselage yet. Glue into place the ¾-inch balsa tri-stock that runs from F1 to F2A.

Turn the fuselage right side up and use a razor saw to cut away the crosspieces between formers F1 and F2. Use thick Zap to glue top formers F1B, F12, F13, F14, F16 and F17 to the crosspieces as shown on the plan. Making certain to leave about 1 inch extending forward of former F14, add the cockpit floor and glue the balsa stringer into the notch on the top of the rear fuselage. Glue in the remaining ¼-inch stringers between F17 and F13. To provide gluing area to support the turtle deck, an ⅛-inch-square stringer runs along the top of the ½-inch longeron on each side from F17 to F13.



The horizontal stab and the fin are airfoil-shaped and are built in upper and lower halves flat on the workbench. Once the halves have been glued together and sheeted, they can be added to the fuselage. Note the fiberglass reinforcing at the center joint of the horizontal stab.



The Webra 1.20 2-stroke engine has more than enough power to fly this fighter. A Slimline Pitts-style muffler easily fits inside the fiberglass engine cowl.

the ½-inch-square stringer into the notches on F12 and F1A, then cut two, ½-inch-square stringers 11½ inches long. To make them easier to bend, make a series of cuts about halfway through each stringer and 1 inch apart, and with the cuts facing downward, Zap them into place between formers F12 and F1B. Use a razor plane to trim the stringers to follow the sides of the formers. Glue rear-cockpit deck F15 to the tops of former F14 and F13. The top turtle-deck stringer fits into the notch in F15.

TURTLE-DECK SHEETING

Cut two, ⅛-inch, contest-grade balsa pieces 22 inches long, and glue together. One end should be 3¼ inches wide, and the other end should be 5½ inches wide. Soak one side of the sheeting in warm water for about 10 minutes; with gentle pressure, it should easily wrap around the formers. Wrap the fuselage with an Ace bandage to hold the sheeting in place while it dries (this takes about an hour). Remove the bandage, trim the turtle deck to fit, and glue it into place.

Glue the ½-inch balsa stab supports to the tail with a scrap of ¼-inch balsa between them. Next, sheet the nose with ⅛-inch balsa sheet from formers F12 to F1B. Use 30-minute epoxy to laminate firewall F1 to F1A and F1B. Using the longerons as guides, align the motor-box opening with formers F1A and F1B. Clamp F1 into place, and allow the epoxy to cure thoroughly. Cut and glue into place the ½-inch, balsa-sheet chin pieces. They should fit between formers F1A and F2A.

Rough-shape the nose with a razor plane and coarse sandpaper. Leave some material for the final shaping with the cowl in place. Fit the ½-inch balsa cockpit side pieces into place, and bevel the edges to follow the curves of the fuselage. The motor box is built from ¼-inch aircraft ply and is set up to fit your own engine/engine-mount combo. Measure your engine, and adjust the box accordingly. Assemble the box with thick Zap, and reinforce all the corners with ½-inch tri-stock. Epoxy the engine box to F1 with 30-minute epoxy.

Glue the cowl-retaining blocks into place, and trial-fit the cowl. When you are satisfied with its fit, screw the cowl into place and finish shaping the fuselage. Trial-fit the engine and mount combo, and make the cutouts for the required cylinder head, exhaust, needle valve and cooling clearance.

FINAL ASSEMBLY

Zap the wing-mounting plate doublers forward of former F4, and epoxy the ¼-inch-ply wing-mounting plates into place. Reinforce them with ¾-inch tri-stock. Secure the fuselage upside-down, and fit the wing into place. Measure to ensure that the wing is square to the fuselage, and tack-glue it into place. The wing scoop is held in place by a hook that's built up from plywood. Glue both SC1 pieces into place at the wing TE centered on the fuselage. Drill a 3/16-inch hole at each mark into the ¼-inch-ply mounting plate. Pop the wing off, tap the mounting plates with a ¼x20 tap, and enlarge the hole in the wing to ¼-inch diameter.

The fiberglass air scoop is latched onto a small hook formed by the SC2 and SC4 pieces at the LE of SC1. The air scoop hides the wing hold-down bolts and the radio charging plugs, which are installed in former F4A. With the scoop in place, sand the bottom of the fuselage to match. Fit scrap balsa between the wing LE and the fuselage, and sand to shape.

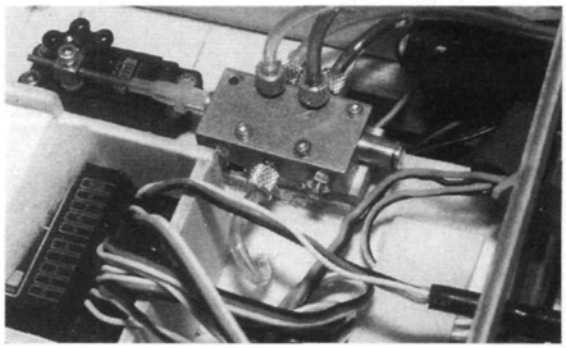
With the wing in place, epoxy the stab and vertical fin into place. Saw, carve and sand two filler blocks to blend in the stab/fin joint. Cut and rough-carve the wing fillets to shape, then fit and glue them into place. Attach the dorsal fin and smooth it out with filler. Tack-glue the rudder into place, and sand it to shape. Detach it, and bevel the rudder's LE.

COVERING AND FINISHING

There are hundreds of well-documented paint schemes for the P-51D. I chose a scheme that I felt was attractive and practical. I got the photos of the "Ridge Runner III" from Scale Model Research*. I used silver MonoKote* for most of the model, with white and dark red trim. I sprayed parts that needed to be painted with Top Flite* LustreKote to match the MonoKote. The photos of the nose art, kill markings and spec plate were scanned into a computer art program, cleaned up and sent to a commercial vinyl shop, which produced the marking shown here—expensive, but worth twice the price when you realize how much work they save you.

Before applying the markings, I scuffed all the MonoKote with a Scotch-Brite pad to give it a weathered appearance. The panel lines are made from 1/32-inch draftsman's tape. I sprayed flat, clear LustreKote over everything to seal the tape and enhance the weathered appearance. Since very few Mustangs were polished like mirrors during WW II, the Ridge Runner III is quite realistic. You can make the cockpit as fancy as you want; the plan shows a scale layout for the instrument panel. I used ⅓-scale instruments from J'Tec* and a ⅙-scale, Hangar 9* pilot figure.

There's nothing fancy about the radio installation, but it is a big job; work neatly. One of the flap servos needed to be reversed, so I used an ElectroDynamics* EDR-106 Pro Servo Reverser. I used a simple, homebuilt servo doubler for the elevators so if one servo fails, the other can still move both elevator halves equally. The doubler is shown on the plan. The 1200mAh battery is packed in foam and placed under the fuel tank. The receiver is secured in a Great Planes Receiver Guard mount box for security.



There is plenty of room for the radio gear in the fuselage. The RX is secured in a padded plywood box built on top of the removable servo tray.

Installation of the Robart 622 retracts is straightforward. The air tank fits under the radio tray, while the servo and control valve sit on top. I used a UP-1 control valve from Ultra Precision*, which gives slow, realistic landing-gear motion.

When I installed the engine, I used a heavy-duty Davis Model Products* Iso Mount to secure it. I fitted the engine with a Slimline* Pitts-style muffler. After the first few flights, I added an on-board GlowLite glow igniter to provide a little extra security at low throttle settings. The Spinner is a 4.5-inch-diameter unit from Zinger*.

That's it for the building. I know you'll love this Mustang, as it is an honest and good performing model. If you've always said you want to build a P-51D, now is your chance; go for it.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 134.* ✈

The new, diminutive SuperNova. There's a built-in fan in the area marked "1 to 25 cells." Just three push-button switches (Set stop, Charge up and Discharge down) handle all the input commands.

FMA DIRECT SuperNova 250S

THE NEXT GENERATION IN AUTOMATED CHARGER SOFTWARE

by Bob Aberle

For a long time, electric-power enthusiasts have been looking for a sophisticated, fast charger/discharger cycling unit with a reasonable price tag. At around $140, the new FMA Direct* SuperNova 250S is such a unit. You can operate it off a car battery or an AC to DC power supply with a nominal 12V DC output at around 20 amps.

The SuperNova is capable of charging or discharging from 1 to 25 cells Ni-Cd or NiMH) and can also charge lead-acid batteries of up to 6 cells or 12 volts nominal but can not discharge them; and it can't be used to charge lithium batteries.

Output fast-charge current levels can be set from as low as 0.10 amp (100mA) to a claimed high of 5 amps for all packs from a single cell up to a total of 25 cells. This means you can charge packs with as little as a 50mAh capacity and up to 1700mAh at a 3C rate (20 minutes to reach full charge!). At above 1700mAh capacity, the 5A charge limit will extend the charging time somewhat; for example, a 3000mAh pack would take 35 to 40 minutes to reach a full charge, at which time an alarm sounds. (If you prefer, you can turn off that alarm.)

Discharge current loads for Ni-Cd and NiMH cells can be adjusted from 0.5 amp to 3 amps. I found the 0.5A minimum discharge current a little too severe for the smaller packs up to about 275mAh. It would have been better to set the minimum discharge down to 0.1 amp for those tiny battery packs.

Discharging will typically continue down to approximately 0.9 volt per cell. There is also a trickle-charge setting exclusively for lead-acid batteries. When charging Ni-Cd or NiMH cells, a trickle-charge doesn't follow a fast charge.

To protect the unit, charge and discharge currents are automatically limited. A warning sounds whenever the input voltage drops below 9.5 volts or exceeds 15.5 volts. If the DC input voltage is hooked up backwards (reversed polarity), the charger won't operate, but nor will it be damaged. In the same vein, if a battery is connected to the output with reversed polarity, the LCD screen will warn: "Output battery—reverse polarity." When it's first connected to the output, a battery pack is automatically checked, and if there is a problem, you'll see: "Output battery—connect error." And as if that weren't enough, the charger will actually "Pause" (it says so on the LCD) or stop if it begins to get too warm when it's charging or discharging. Then, after cooling down for a short period, it automatically resumes the charging or discharging.

The FMA Direct SuperNova charger is housed in a rugged aluminum case that's 5½ inches long, 3½ inches wide and 1⅝ inches thick. Two side mounting brackets are supplied; if they're installed on each side of the case, they elevate the charger to a convenient angle. A miniature internal fan helps to keep its temperature down, as does a thick aluminum heat-sink plate that runs along the top of the case. The output connectors require standard banana plugs, which are not supplied.

On the input side, the cables are 36 inches long with what appears to be an in-line fuse that's inserted into the cable. The output cables end in two large, color-coded, alligator clips. There is no main power switch, so when you connect it to a car battery, there will be an initial spark. I'm not fond of that feature in any charger, so I usually insert an in-line switch in one of the input leads. After doing that, it is easy to first attach the alligator clips to the car battery and then flip the switch to turn on the power—no sparks!

On the face of the SuperNova charger are three push-button switches designated "Set stop," "Discharge (down)" and "Charge (up)." They enable you to select and set the charger/discharger inputs and other parameters. Control commands and inputs are monitored on a front panel (two line) LCD measuring 2½x$^{9}/_{16}$ inches.

WHAT MAKES IT SPECIAL?

Beyond its being inexpensive, this unit's software is unique, to say the least. It will allow you to connect any battery—within its acceptable parameters—and will automatically charge or discharge it without your having to set any input commands. So if you aren't sure which charge or discharge current to select for any pack, just call up the "Automatic" mode and simply press "Charge" or "Discharge," and the SuperNova will do the rest automatically. If you select Charge, the battery will be fully peak-charged and the unit will cut off.

The first display to come up on the LCD screen whenever the power is turned on. From here, you can charge a pack automatically or you can choose the manual mode.

A typical display while auto charging: "C" stands for charge; 142mAh have been put back into the battery. The voltage under charge is 11.38 volts and the charge current is 1.13 amps.

At the end of a charge, the display will show "F" for "finish." In this case, the charge took 11:34 minutes. If you want more data on the battery, you must call up "Reference data."

Once in "Reference data," you can retrieve all the parameters that were obtained during the discharge/charge cycle. Here, the display shows the number of minutes the battery was on "Char." (charge) and "Disc." (discharge).

In this photo, the display shows the "Char." (charge) capacity put into the battery (1338mAh) and the "Disc." (discharge) capacity taken out of it (1078mAh).

Charge voltage is shown here. In this case, the peak ("P") was 10.376 volts; "Va" means voltage average.

By switching to a submenu—"Reference data"—you will be able to call back any parameter that interests you such as peak voltage at full charge, the capacity in mAh put back into the battery, the average charge current, to mention a few. If you are discharging, it will tell you the battery capacity in mAh. Those parameters will remain on the LCD until you have disconnected the battery pack from the charger.

If, in the automatic mode, you first choose "Discharge," the proper load current is selected for you and discharging begins. It continues until the pack reaches approximately 0.9 volt per cell, at which time it stops discharging and automatically begins charging. At the completion of charging, you will be able to recall all of the parameters attained during both the discharge and charge portions of the cycle. You will have no control over this automatic charging after discharging, so your choices are charge only or discharge, after which charging occurs automatically. This charge-after-discharge sequence occurs in the manual mode as well.

In addition to the automatic mode, the SuperNova also has a very extensive manual mode that can be set up to do just about anything. To make life even easier for you at the flying field, FMA engineers established a series of preset battery charging/discharging conditions for many popular combinations of battery cell count, capacity and cell type. Ten preset conditions are permanently stored in the SuperNova's microprocessor. You can temporarily alter any of these for a one-shot charge or discharge "modification," or you can establish your own preset for a battery pack in your inventory and store it permanently in the SuperNova's memory. If you ever want to, you can return all of the presets to their original factory settings.

In a typical manual mode charge/discharge sequence, attach the battery pack to the output connectors, press the set/stop button to scroll to "Battery" (which will be flashing). Press set/stop again to get to "Select" (flashing). You can now select a preset and go immediately into charge or discharge, or you can go into "Set" (flashing) and from there go down the menu and make your changes to battery type, battery cells (number of), battery capacity, charge current, or discharge current, and then go back to Set and then Exit. Having made these modifications to a preset, you're assured they are now stored in the SuperNova's memory. You can then proceed with manual-mode charging or discharging or both.

The one thing you must learn right from the start is that in manual mode, you can't just set a charge or discharge current value and hit the start button; it isn't quite that simple. You must always first call up a preset and then modify it, though there is one slight variation on this routine: let's say you selected a preset and started charging. Early on, you realize that you have the current set too low and that it will take too long to reach a full charge. While in the charge (or discharge) mode, you can increase current or reduce it as a "one-shot" deal. So if I start a 1200mAh pack at 1.2 amps (which might take an hour), I can easily boost the charge current up to 3.6 amps (3C rate) and have the battery at full charge in just 20 minutes. That option is always open to you.

As originally conceived, the SuperNova was not intended to perform C/10 or overnight charging, but Fred Marks of FMA Direct suggested something I'll pass on to you: if you select the lead-acid battery, you really don't have a peak-detect circuit in effect; you can set the average voltage for your pack and the C/10 charge

SPECIFICATIONS

Product: SuperNova 250S microcomputer fast charger.

Model no: FC700

Manufacturer: FMA Direct Inc.

Type: automatic or manual mode peak-detect battery charger and discharger capable of handling Ni-CD, NiMH and lead-acid batteries.

Size: 5½x3½x1⅝ in.

Input: 12V DC from lead- acid (car) battery or a 12V DC power supply with at least a 20A output.

Input cables: 36-in. long with large alligator clips.

Output connectors: banana plugs (mating half not supplied).

No. of cells: 1 to 25

Cell capacity: 50 to 3000mAh

Charge current: 0.1 amp to 5 amps

Discharge current: 0.5 amp to 3 amps

Street price: $140

Comments: capable of automatic peak fast charging and discharging. The SuperNova decides the proper charge and discharge current. In the manual mode, you can store up to 10 preset charge/discharge currents for your specific battery needs. These presets can easily be modified permanently (stored in the memory) or temporarily.

Hits

- Automatic mode takes all the guesswork out of charging; just connect a battery and press a button!
- Very low price for such a sophisticated charger/discharger.
- Input and output connections are reverse-polarity-protected.
- Can charge/discharge Ni-Cd and NiMH cells and charge lead-acid storage batteries.
- Lowest charge current of 0.1 amp permits the charging of tiny 50mAh Ni-Cd batteries.
- If any charger parameter is exceeded, the unit will pause or stop for added protection.
- Sound confirms end of charge.

Misses

- Instructions are quite extensive and require extra patience during the initial learning process.
- Manual charging/discharging is not attainable directly; you must first call up a preset and then go with it or modify it.
- At a higher cell count (21 to 25 cells), the maximum charge rate of 5 amps is not attainable when working off a 12V car battery.
- Discharge current should be able to go lower than 0.5 amp (0.1 amp would be better for testing batteries with smaller capacities).
- No main power switch. Because of this, there are sparks when you attach the input alligator clips to a car battery terminal.

rate, and it will continue to charge indefinitely. I tried this with a 6-cell 1700mAh pack. The voltage was set at 8, and the charge rate was set at 0.2 amp (200mAh). You can set the current only to 1/10 amp, so the 0.2 was as close as I could get to the 0.17 amp that I wanted. Under these conditions, the SuperNova did work, so this is an option you might want to try.

My final test was to see whether the claimed charge rates could be actually attained. If the specs call for 5 amps at 25 cells, you should be able to obtain that charge level and cell count when operating off a standard car battery. I didn't quite have a 25-cell pack handy, but I did manage 21 cells at 1700mAh. I was able to obtain 3.2 amps with the 21 cells, but I couldn't get to the specified 5 amps. Was I disappointed?—not really, since I usually charge packs of 10 or fewer cells. When I *do* have to charge 32 cells for a ¼-scale model, I break the battery into two, separate, 16-cell packs and use two chargers, so not being able to reach 5 amps at 25 cells isn't a problem for me.

I mentioned my observation on charge current to FMA president Fred Marks, who kindly sent me this statement for publication:

"When charging up to 21 to 25 cells, the maximum output current may not be 5 amps. The actual output is determined by the condition and internal resistance of the cells in the pack and the condition and voltage of the supply battery. In general, the charge rate will hold as high as 3 amps at the upper range. It may be more than 3 amps but will not be less. Do not be tempted to start your car engine to jack up the charge rate, as that might damage the charger."

Indoors, I used an AC to DC power supply rated at 12V DC and 10 amps. I charged 10 cells at up to 5 amps. If you must charge the full cell count of 25 at 5 amps indoors, I suspect you will need a supply with a rated output of at least 20 amps or more. My 10A supply, by the way, was capable of discharging 25 cells at up to the 3A maximum-load rating.

A few words about the instruction manual. It is well-written and thorough but contains a tremendous amount of information. I read it several times before attempting to use the unit. At first, I was snowed—so much so that I exchanged several emails with Fred and Tim Marks of FMA Direct. They encouraged me to just get into using the charger. In other words, try it; just don't keep looking at it and reading the instructions. After a few charge/discharge cycles, it started coming to me; after a week of using it regularly, it became second nature to me. At this point, I realized that from a technical standpoint, this unit is sensational and—better yet—it is not expensive.

The FMA Direct SuperNova 250S may set the pace for battery chargers in the new millennium. For the money, it can't be beat! Since it is so computer (software) oriented, I get the feeling this first product is the tip of the iceberg. I can see many extra features being easily added as experience builds with this unit. I'm very glad I started at the beginning with this new product and look forward to using it when I once again attend the AMA/NEAC Electric National Championship in Muncie, IN, on July 30 to August 2, 2000.

**The address of the company featured in this review is listed in "Featured Manufacturers" on page 134.*

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TTR4522

Fun Tigers

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Length:	43"
Weight:	4 lbs.
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Radio:	4 Channel

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Make Lightweight Foam Wheels

by Randy Randolph

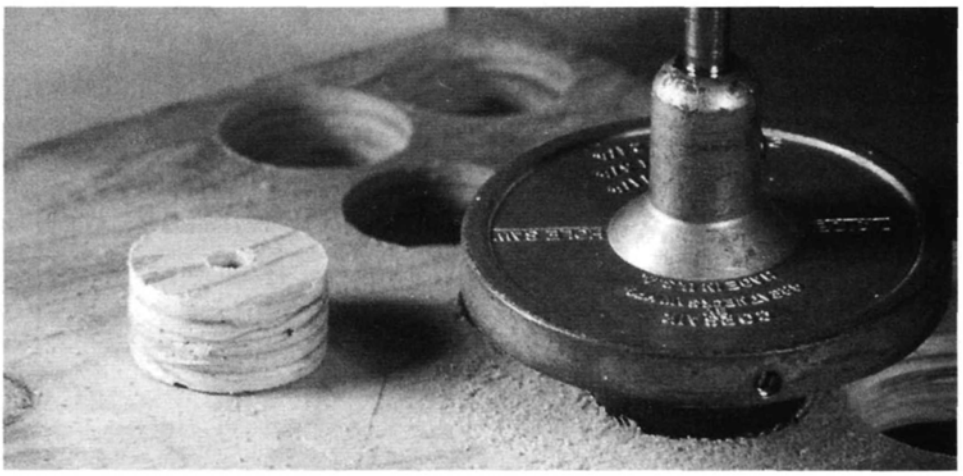
The increased popularity of lightweight RC airplanes that fly indoors or in confined areas outdoors has put the emphasis on light structures. One area where excess weight can be reduced easily is in the landing gear—specifically, the wheels. Most commercial wheels are intended for heavier loads than lightweight airplanes require. Here is a quick and inexpensive way to make wheels that offer a significant reduction in weight.

The wheels shown are for a small aerobatic airplane, but you can make very light, indoor RC wheels by changing the hub from ½-inch plywood to ¼-inch balsa. The tires are made out of pipe insulation (available at plumbing supply houses and hardware stores). The insulation is sold in 1- to 3-inch outside diameters and varies in density depending on material composition. All are inexpensive and will work well in this application.

YOU'LL NEED

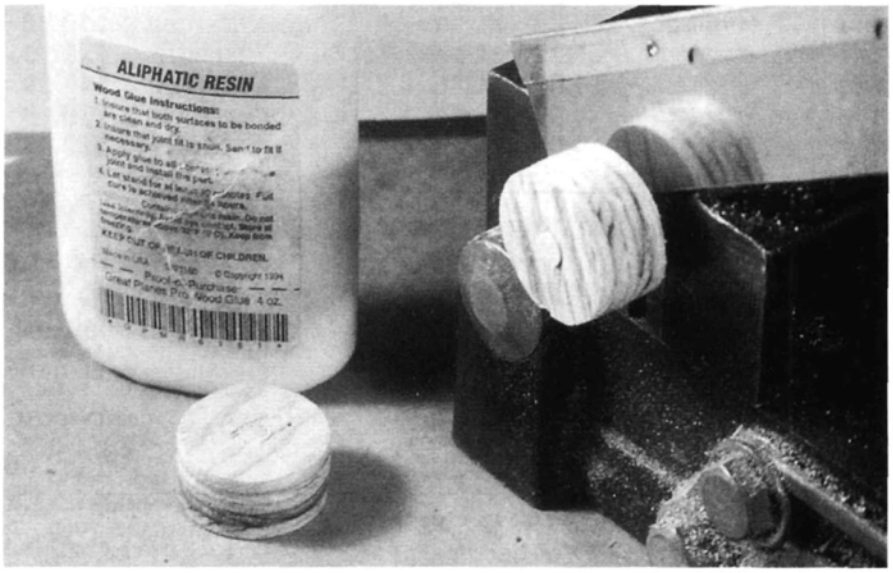
- ½-inch plywood or ¼-inch balsa.
- Pipe insulation.
- Drill and bits.
- 1¼-inch hole saw.
- ¼-inch dowel.
- Band or razor saw.
- Sandpaper.
- Aliphatic resin or epoxy.
- Brass tube and axle-size wire *(for outdoor wheel use).*

A different spin on things!



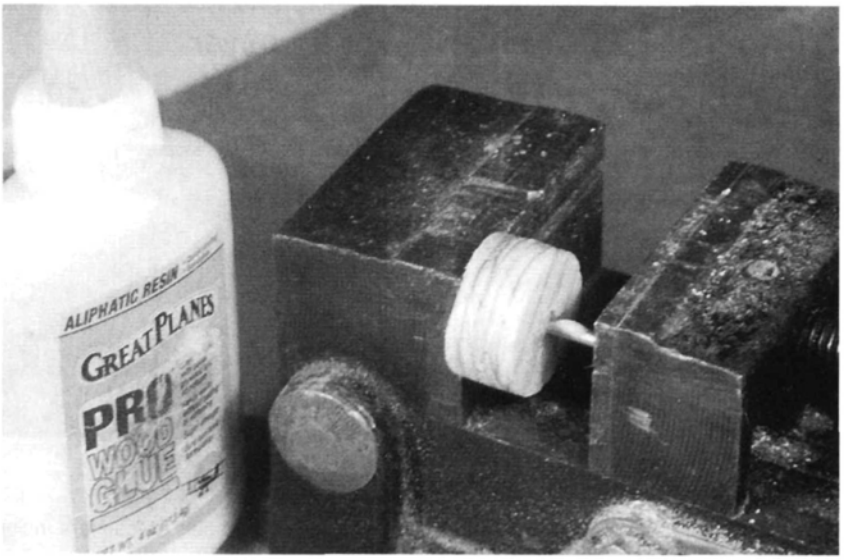
PHOTOS BY RANDY RANDOLPH AND WALTER SIDAS

1 First, make the wheel hubs; they should be about ⅛ inch *larger than the inside diameter* of the insulation. In this case, I used a 1¼-inch hole saw to cut hubs of the correct size for 2¼-inch wheels. Drill only halfway through the material—in this case, ½-inch plywood—then finish the hubs by drilling from the opposite side. This way, the wood will not split or chip when the saw exits the material.

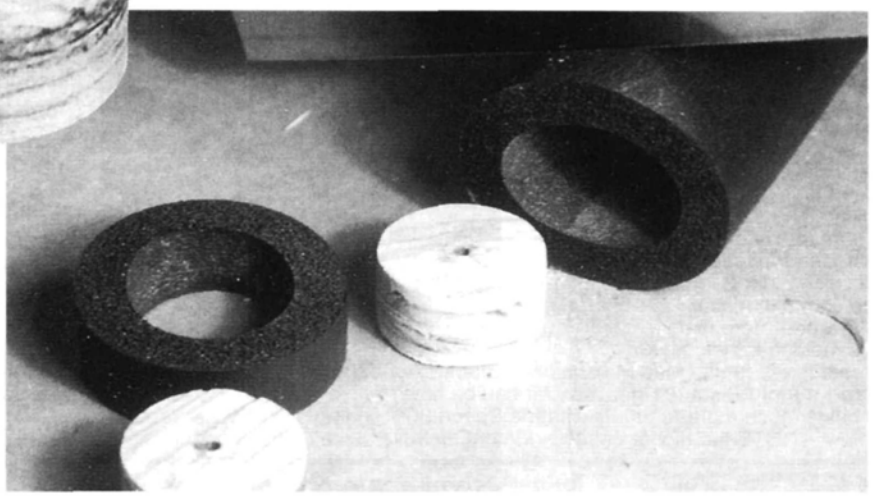


2 Fill the ¼-inch hole that the hole saw left in the center with a piece of ¼-inch hardwood dowel. Glue the dowel into the wheel and trim it flush with each side; then smooth out any rough spots with a sanding block.

3 When the glue has set, drill a hole in the center of the dowel to match the axle. If the wheel is for indoor use only, the hub is complete. Otherwise, drill a hole large enough to accept a brass tube that will act as a bearing.

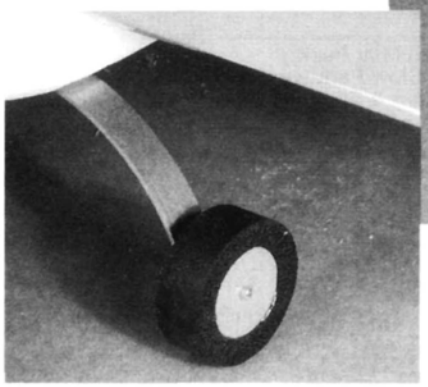


4 Apply glue to the hole in the wood as well as to the exterior of the brass tube. Use a vise to push the tube into the hub. Clean any glue out of the bearing with a piece of wire that's the same diameter as the axle.



5 I found that air-conditioning pipe insulation makes the best tires. The pipe insulation should be cut about 1/32 inch wider than the hub. If you don't have a band saw, a razor saw is a good substitute.

6 The best time to color the wheels is before the tires have been cemented to the hubs. You can paint them or use matching plastic iron-on film. Aliphatic resin or epoxy seems to be the best adhesive for holding the tires on the wheels. Be sure to glue the insulation's seam as well.



7 Left: the finished wheels look good, roll smoothly, absorb shocks and weigh less than half of those available commercially. +

Sneaking up on forward flight

In my May 2000 column, I described some hovering exercises that help you learn how to control the tail rotor and how to start moving your heli in the desired direction of flight. Now we'll take the next step and sneak up on forward flight.

Before you begin, please make sure that the main blades have at least 3 degrees of negative pitch. If you don't, you'll find trying to transition from forward flight to hovering very difficult. Also be sure that when the throttle trim is all the way up, the motor holds a fast idle.

Last time, I described how I walked behind the heli and used tail-rotor-control inputs to change the direction of the nose and keep the heli moving forward. Well, now we'll fly the heli forward, but this time, we'll stay in one spot and move the heli from side to side using the same control inputs (the heli will do S-turns; see Figure 1).

1. Starting from the home position, bring the heli into a stable hover and give a left or right cyclic command to start it moving sideways. Modulate the cyclic to keep the heli moving slowly.

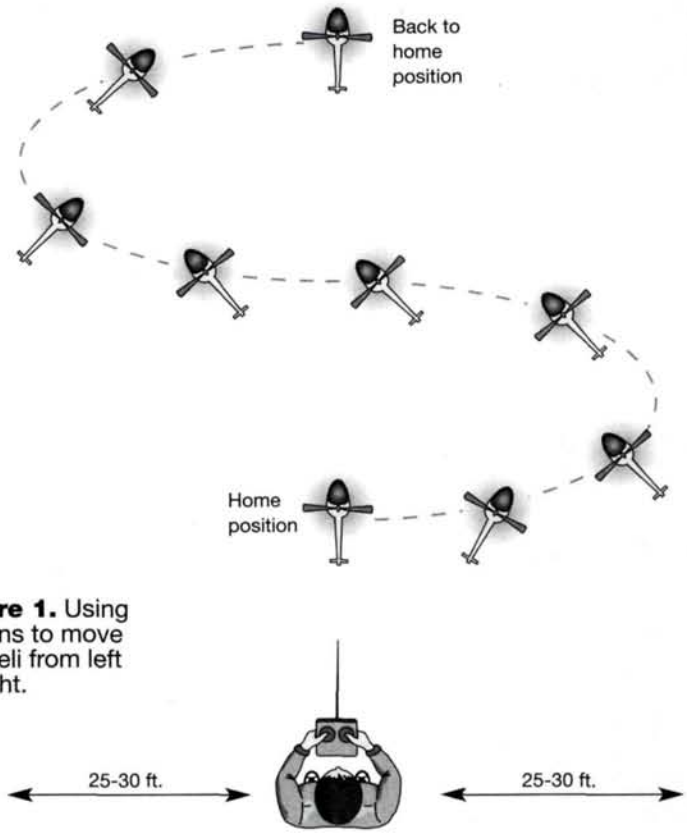


Figure 1. Using S-turns to move the heli from left to right.

THE NEWEST HELI GEAR

I just returned from my annual trip to the Westchester Radio Aero Modelers (WRAM) show in White Plains, NY, and want to share the news of some of the new heli products I saw there.

Helicopter World* came all the way from the West Coast with its low-cost, high-performance, .30-size Hawk and .46-size Falcon helis. These offer a great way to get into helis without breaking the bank. The company also introduced its new Schweizer 300, which is based on the proven Hawk mechanics (an optional, scale, 3-blade head really dresses it up) and also offers tools, rotor blades, scale bodies and a complete line of upgrade parts for most helis.

Helicopter World's new Schweizer 300 is based on the mechanics of the proven Hawk.

Miniature Aircraft's new, all-aluminum, CNC-machined tail rotor is an upgrade for most X-Cell helicopters.

Miniature Aircraft USA* displayed all of its goodies, including some new ones: an aluminum tail-rotor gearbox features CNC-machined parts and a stainless-steel hub. It's standard on the XL-Pro and available as an upgrade for most X-Cells.

2. As the heli moves to either side, use the tail rotor to keep the tail pointing toward you (doing the zigzag helped you to learn this).

3. When the heli is 25 to 30 feet away, reverse the controls and bring it back to the home position.

4. Repeat the maneuver, flying in the opposite direction.

Repeat this pattern of moving the heli from side to side until you can fly it from your far left to far right and then back. When you feel comfortable doing this, start to use more tail rotor and point the heli's nose in the direction of flight (see Figure 2). Don't get discouraged if it takes you some time to do this correctly. Don't let the heli move too fast, or you'll get behind the control inputs and mess up your whole day! Also, when you turn at your far right and far left, change the direction of the nose, mostly by using tail rotor, and use only small roll-cyclic inputs to help the heli through the turn. Do not—under any circumstances!—let the heli stop or let its nose point directly toward you, as this will be nose-in hovering, and the control orientation will be the opposite of the heli's movements. You aren't yet ready for this.

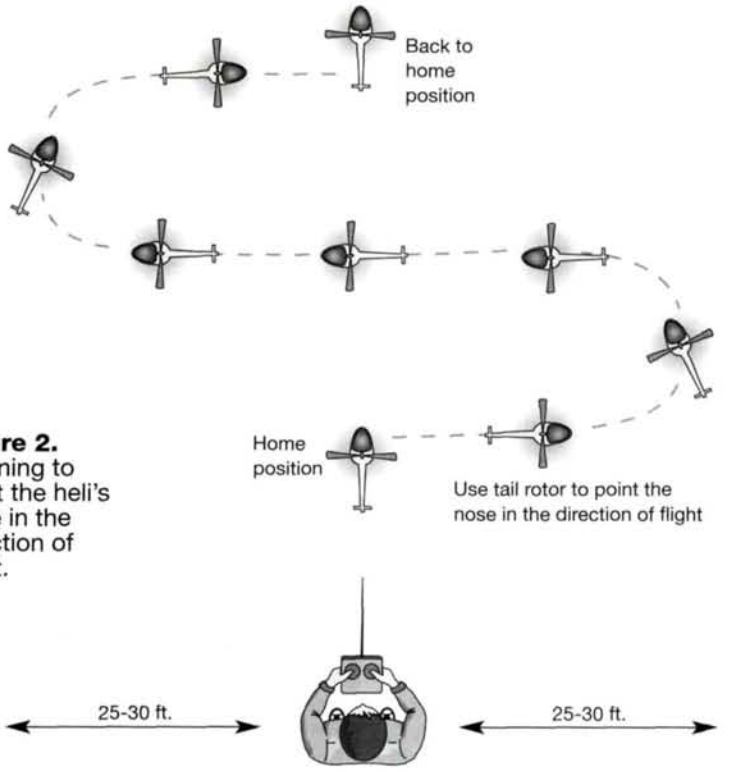


Figure 2. Learning to point the heli's nose in the direction of flight.

This exercise will build your confidence in looking at the heli from a variety of perspectives and will teach you to coordinate cyclic and tail-rotor inputs. As this becomes easier for you, increase the distance between the right and left turning points and increase speed and altitude. Before you know it, you'll be in forward flight! As you can see, S-turns offer an easy way to sneak up on forward flight; they also teach you how to turn the heli in both directions.

Hirobo* displayed its fine line, including the new SST-Eagle 2 WC machine, which features a carbon-fiber frame and canopy and all-metal construction—truly beautiful—and the new collective-cyclic-pitch mixing (CCPM) Shuttle, which is based on the proven Shuttle design. The Shuttle will be offered as a complete kit and as a Shuttle upgrade. Hirobo's senior product manager, Jeff Green, hinted that some new .60-size scale helis are in the pipeline. I'll keep you posted.

Above: Hirobo's beautiful SST-Eagle 2 features carbon-fiber rotor blades and canopy. Below: JR's new Head Lock Gyro, the G5000T, is a compact, lightweight unit that's easy to set up and features the latest technology.

Very exciting was JR's* G5000T—the much-rumored new Head Lock Gyro that Curtis Youngblood has used for some months. It's compact and light (only 1.82 ounces) and features easy setup, rate- and tail-lock modes and patented offset-drift-canceling circuitry. JR's new Vigor is gaining quite a following in the heli circuit and was also on display.

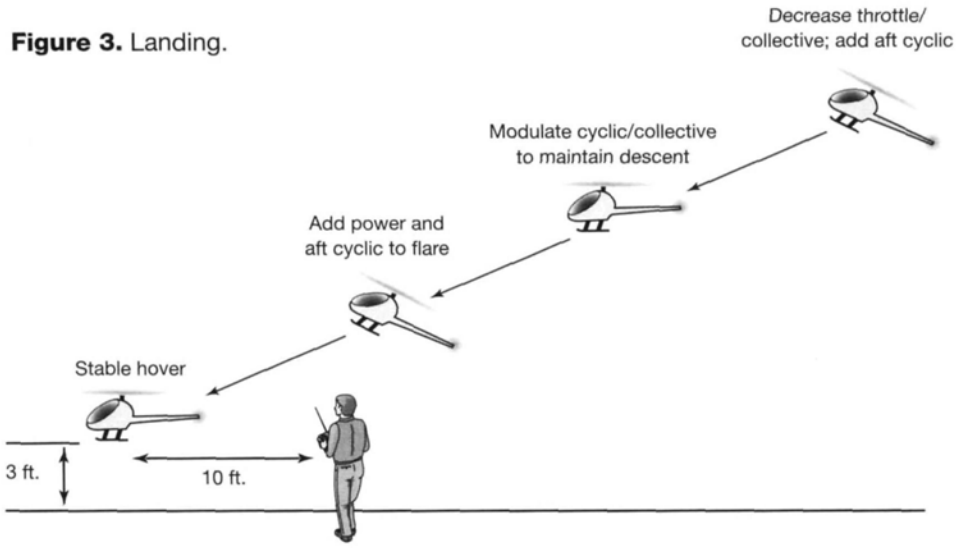
LANDING SAFELY

Now that you're up and flying around, you need to get the heli back down, and this is where most novices get into trouble (see Figure 3). To come out of forward flight, decrease throttle/collective pitch and apply aft cyclic to slow the forward speed (if there's any wind, be sure to fly into it). Don't be afraid to lower the collective stick to bring the heli down; this is where negative pitch comes into play to establish a descent. Because the rotor disc is more efficient at forward speeds, negative pitch will help to pull the heli down.

Now establish a descent rate that will result in the heli's hovering about 10 feet past you; modulate the throttle/collective and the fore and aft cyclic so that the heli reaches that spot. During the descent, always maintain forward speed; again, you don't want the heli to stop and face you nose in! If forward speed begins to decrease, just push forward cyclic, and the heli will keep flying forward.

As the heli gets closer to the spot you're aiming for, start the flare by adding aft cyclic to reduce forward speed; this will stop the descent and return the heli to a hover. Now add power and push the heli's nose down to a level, stable hover at an altitude of about 3 feet. Don't try to land it directly from the approach; this is guaranteed to lead to a crash! Recover to a stable hover, then land.

Figure 3. Landing.



As you can see, landing a heli is a balancing act of sorts—not difficult, but you'll have to practice. If you can get help from an experienced heli pilot, he will make sure that your machine is properly set up for forward flight, will demonstrate the steps and talk you through those first circuits and landings.

Well, that's it for this time. Keep practicing those S-turns until you feel comfortable moving on. Fly safely and with purpose!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 134.* ✦

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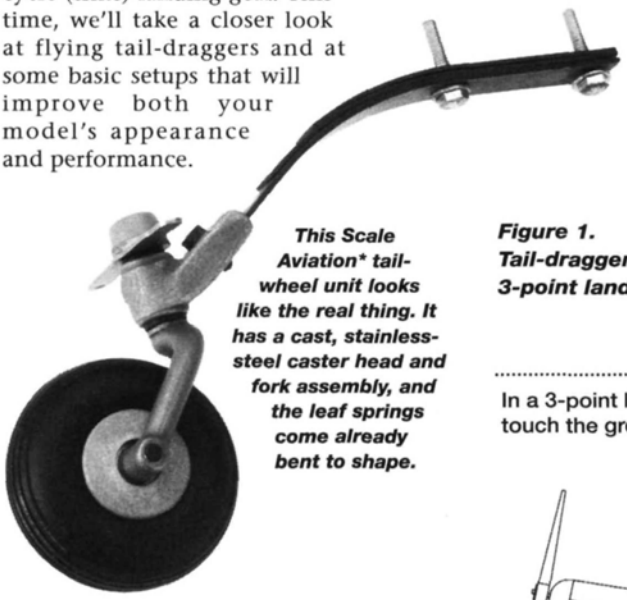
Taming the tail-dragger

One of the most overlooked parts of our big airplanes is the tailwheel—probably because it needs relatively little maintenance and usually lasts longer than any other part on a model's airframe. Though the tailwheel itself affects a model's flight performance very little, the tail-dragger configuration makes takeoffs and landing very different from those of planes with tricycle (trike) landing gear. This time, we'll take a closer look at flying tail-draggers and at some basic setups that will improve both your model's appearance and performance.

On landing, a tail-dragger such as this 30-percent-scale Staudacher can be a handful if you allow it to slow down too much on final approach. High-performance aircraft behave much better if you use a 2-point wheel landing.



This Scale Aviation* tailwheel unit looks like the real thing. It has a cast, stainless-steel caster head and fork assembly, and the leaf springs come already bent to shape.

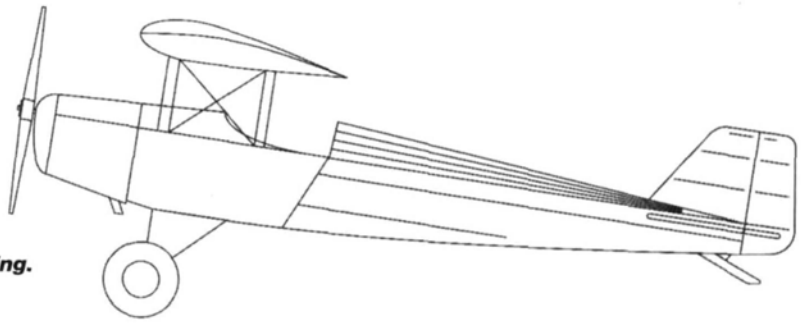
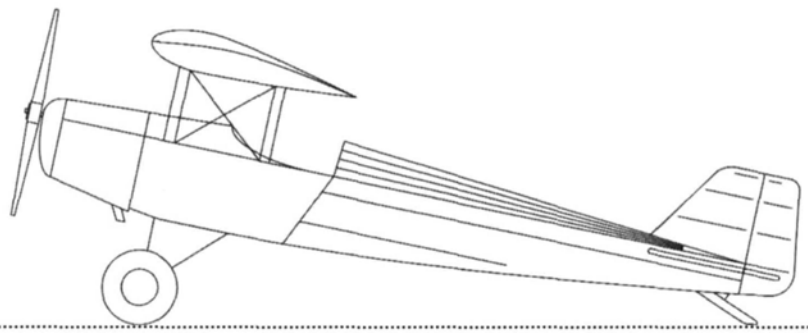


Figure 1. Tail-dragger 3-point landing.

In a 3-point landing, the model is flared into a nose-high attitude before the main wheels touch the ground. This slows the model down and shortens the landing rollout.



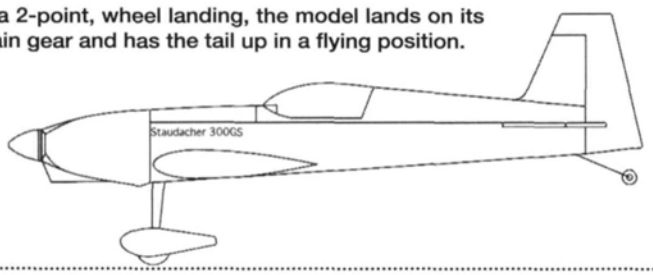
The 3-point landing is also know as a stall landing because the model is almost completely stalled by the time it contacts the ground.

WHAT'S THE DIFFERENCE?

The major difference between a tail-dragger and a trike-gear model is the position of the CG relative to the main gear. On a trike, the CG is in front of the main gear, and when the model lands, the nose tilts downward until the wheel

Figure 2. Tail-dragger wheel landing.

In a 2-point, wheel landing, the model lands on its main gear and has the tail up in a flying position.



As the model slows down, the tail comes down and the tailwheel contacts the ground; as it does so, the model's AoA increases and if it hasn't been slowed enough, it can become airborne again. Holding in some down-elevator to hold the tail up longer will help slow the model during the rollout,

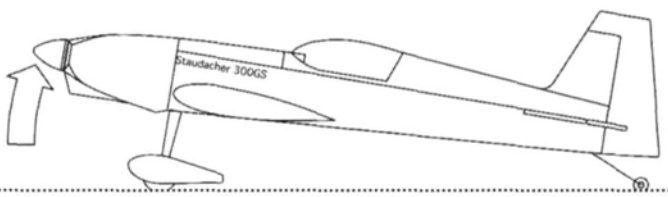
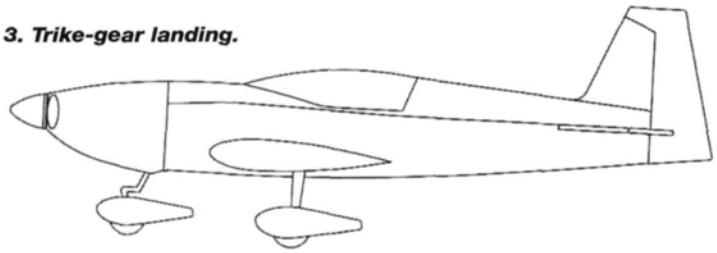
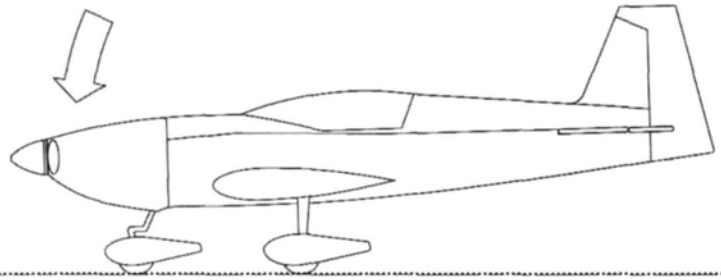


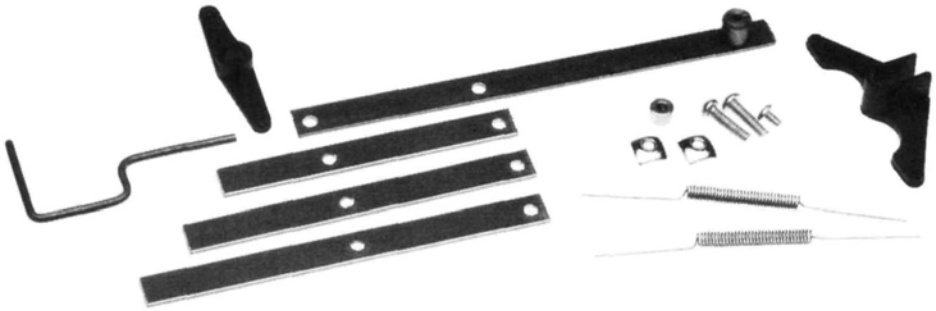
Figure 3. Trike-gear landing.



With a trike-gear airplane, the model is brought in for landing with the nose slightly up. This allows the main gear to contact the ground first.



Because the model's CG is in front of the main wheels, the model's nose tilts downward and lowers its AoA, thus helping to keep the model on the ground.



The CB Associates* leaf-spring tailwheel assembly has been around for a long time. For best performance, you should bend the music-wire-axle/tiller pivot wire slightly so the wheel trails behind the pivot point.

Available in two sizes, the molded-plastic Klett* tailwheel unit is very popular with sport modelers because it will take a lot of abuse and is practically indestructible. Note that the rudder-tiller arm has holes for both the rudder's pull/pull linkage and for the coil springs.

touches the ground. This decreases the wing's angle of attack (AoA) and helps to keep the model on the ground. With a tail-dragger, the CG is behind the main gear, so on landing, the nose tilts upward until the tailwheel or skid touches the ground. This increases the plane's AoA, and if it has not been fully stalled on landing, it might become airborne again; that's why takeoffs and landings are so challenging.

You can basically drive a trike-gear model around without much thought: push the rudder stick right and the model steers right—no surprises; but a tail-dragger can dish out a few surprises if you aren't alert to the possibilities.

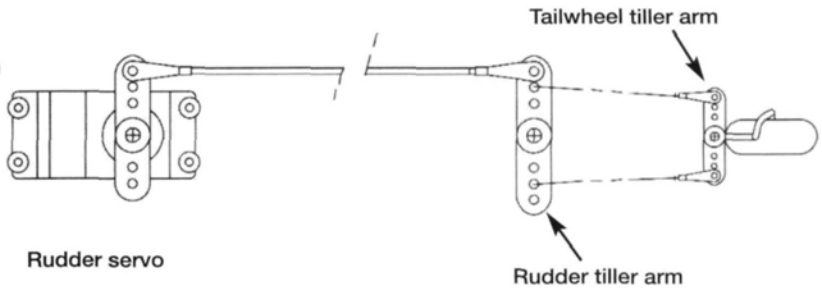
Tail-draggers, especially those with a tailskid, behave much better on grass runways. The drag of the rough and soft earth surface helps to keep a tail-dragger going straight after landing. On a hard surface such as a paved runway, a tail-dragger can easily be overcontrolled, and that causes the tail to swing around in what's referred to as a "ground loop." There is very little drag or friction to keep the tail aft, and you must be quick on the rudder to maintain directional control.

Generally, a tail-dragger's turning radius is larger than a trike's because the main gear is much farther from the tailwheel, thus giving a bigger arc.

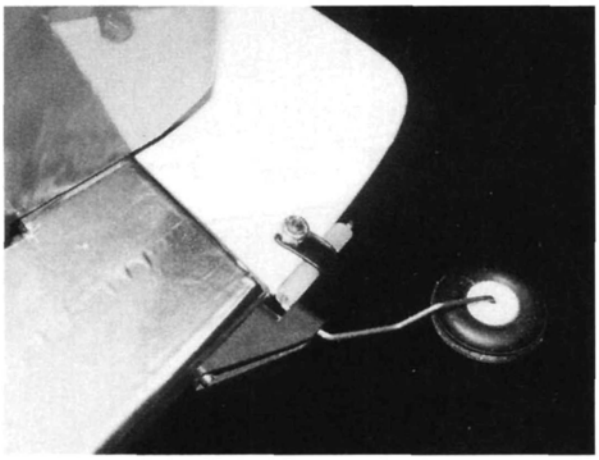
During takeoff, torque from the engine and prop tend to make a model veer to the left, so right-rudder correction is required to keep it going straight. Trike aircraft have good directional control: both the nosewheel and the rudder work to maintain direction. With the tail-dragger, however, the tailwheel lifts off the ground during the takeoff roll, so you must count on rudder only for torque correction.

Figure 4. Typical tailwheel geometry setup.

The tailwheel tiller arm should be smaller than the tiller arm attached to the rudder. This gives a mechanical advantage to the rudder and minimizes the forces from the tailwheel .



The P-51 Mustang is a good example of a model that has its tailwheel forward of the rudder hinge line. A separate steering servo makes the steering linkage much simpler.



A tailwheel assembly in its simplest form: a bent piece of music wire supported by a plastic bracket. Note the rubber tubing at the top; it helps to absorb landing shocks transmitted to the rudder.

LANDINGS

There are two types of tail-dragger landing: a 3-point, or stall, landing and a 2-point, or wheel, landing. The type of model you fly and wind conditions dictate the best type of landing for you. If you have a high-wing, high-lift model such as a Piper Cub, you will, in most cases, be able to flare to a 3-point landing; this type of model is very forgiving and has predictable stall characteristics. If you have too much airspeed during a landing, the worst that can happen is that you simply won't be able to land, and the model will float past your intended landing spot.

While landing in blustery or crosswind conditions, a wheel landing is the best bet for a lightly loaded model, as you can bring it in at a higher airspeed and maintain positive control for a longer time.

With a model such as a Cap 232 or a Pitts Special, most—if not all—of your landings should be wheel landings. This is because the wing of an aerobatic model tends to stall more abruptly at lower speeds, and the model's AoA is much more critical on landing. If you flare into a 3-point landing attitude too early, you could stall the wing and cause the model to drop in—*hard*! With either type of model, use throttle to adjust the rate of descent and the elevator to control AoA and airspeed.

A tailwheel offers several advantages over a nose wheel:

- It's much smaller and lighter, and this causes less air drag while flying.
- Tailwheel linkage is very simple and straightforward.

Tail-draggers with tailskids—such as this 1/4-scale Bristol Scout—do not like smooth, hard, paved runways because they offer little friction to hold the tail aft; can you say "ground loop"?

- Tailwheels absorb landing impacts better than nosewheels do because they don't touch the ground until the tail feathers stop flying; when the tail comes down, much of the speed has been dissipated.

INSTALLATIONS

A tailwheel can be attached directly to the rudder or to the bottom of the fuselage and then connected indirectly to the rudder for steering control. I think the fuselage attachment is much better because the indirect connection to the rudder isolates the rudder servo from the jolts and bumps associated with taxiing (see illustrations).

The most common way to attach the tailwheel's tiller arm to the rudder is with a pair of springs. When the tailwheel is positioned below the rudder, the springs prevent the rudder from being damaged by side loads. With big warbirds and other aircraft whose tailwheels are some distance in front of the rudder hinge line, separate pushrods or cables directly attached to the rudder servo are preferred. This setup can also be used with a separate servo for steering control; the steering servo can be driven with a Y-harness connected to the rudder servo.

Several tailwheel configurations are available; units with steel leaf springs are popular because of their scale appearance, while composite frame units are popular with sport models. One of the simplest setups uses a bent piece of music wire supported by a molded-plastic bracket. When you install your tailwheel, pay attention to the linkage geometry. Make sure that the tailwheel is straight when the rudder is in the neutral position. Also, to make steering control more positive, make the tailwheel's steering deflection greater than the rudder's. Do this by using a longer tiller arm on the rudder and a shorter tiller for the wheel (see Figure 4).

Most scale aircraft flown today are tail-draggers; from WW II bombers and fighters to classic civilian and race planes, the tail-dragger configuration continues to be popular. If you haven't tried a model with a tailwheel because you don't think you're up to the task, go ahead and give it shot; all it takes is a little understanding and some practice. Once you've mastered a tail-dragger, you'll be able to fly anything.

Astro Flight News

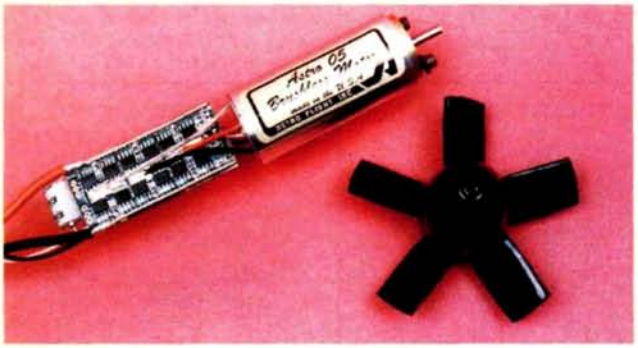
Astro Flight Inc. Introduces five new and exciting products for the electric flyer: The new Mighty Micro 010 Brushless Motor for park flyers, a new Ducted Fan Brushless 05 Motor for the Kyosho T-33, FAI-035 and FAI-05 Planetary Motors for Sailplanes and two new surface mount digital speed controls.

The Mighty Micro is here!

Our new Mighty Micro Brushless 010 Motor #801 has arrived. The motor is one inch in diameter and one inch long and weighs only 35 grams with sensorless control. It spins an APC 6x2.8 prop at 9800 RPM while drawing only 2.5 amps from a six cell 350 mahr Nicad pack. Now you can fly for 5 minutes on Nicads, 10 minutes on Hydrides and one hour on lithium cells. The tiny On-Off Brushless control has Brakes and BEC. This system will work with 5 to 8 cell batteries. Perfect for models up to 10 oz.

New Ducted Fan 05 Motor!

Our new 4 turn Brushless 05 Ducted Fan Motor #805F with 12 FET controller is specially designed to add Afterburner performance to the Kyosho T-33 and WE-Mo-Tek 480 ducted fan units. Run the T-33 fan on 8 or 9 Nicads or 10 Sanyo 3000 mahr Hydrides. The motor draws only 19 amps for 10 minute flights on Hydrides.

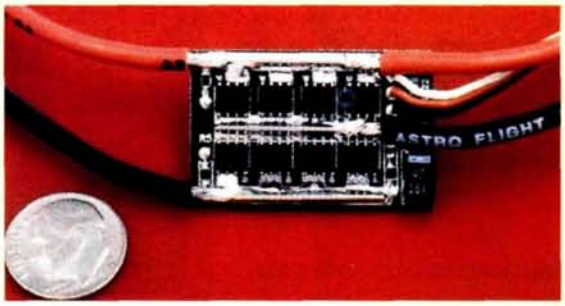


FAI-035 with Planetary Gearbox

Our new 4.4:1 planetary gear box is now available for all Astro Cobalt 035, 05 and 15 motors. The FAI-035 with planetary gear box is perfect for 7 cell competition sailplanes. The FAI-05 with planetary gear box, shown here, is perfect for 10 cell sailplanes.

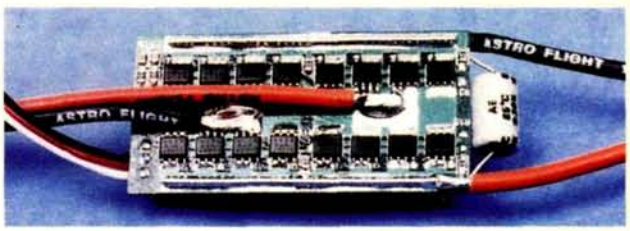
New Astro 215D Airplane Control

The new Astro 215D Speed control uses new surface mount technology for minimum size and maximum performance. The tiny 215D weighs only 8 grams and has Brakes and BEC. It handles up to 30 amps and 10 cells. Perfect for Astro Cobalt 035, 05 and 15 motors.



New 208D Reversing Control

The new 208D Reversing Control is designed for scale boats. It's 16 FET H-Bridge circuit gives you full power forward and reverse. The 208D weighs 1 oz and can handle 25 amps at 6 to 12 volts. It has a 2 amp BEC and a electronic current limit of 28 amps, so no fuses are needed. It was designed for tug boats and works great with 150 pound robots and electric powered blimps.



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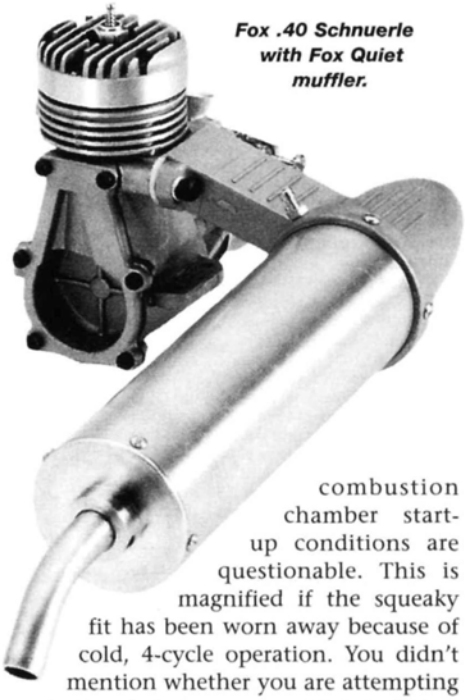
Answers to common engine questions

One of the more interesting facets of writing "RPM" is the positive feedback and questions I receive from readers. Because many modelers probably have similar questions, I will devote this month's effort to some recent letters and hope that the answers will be of interest to you.



Fox .40 Schnuerle with Fox Quiet muffler.

ENGINE EFFICIENCY

Ray Baker of Wilmington, OH, has a question about engine efficiency: "I have your book, '2-Stroke Glow Engines for R/C Aircraft.' It says a lot about speed but little about economy. Is there a formula or guideline concerning timing, etc., for attaining fuel efficiency?"

Although I don't know of any formulas for reaching this goal, there are some guidelines that should lead you in the right direction.

The best way to extract the maximum mechanical energy from any chemical fuel in a heat engine is to raise its operating temperature. In the case of a piston engine, this is accomplished by raising the compression ratio. There are limits in terms of combustion defects such as "knock" (detonation) and pre-ignition. Some fuels are better suited than others in terms of their ability to tolerate increased compression. Methanol (methyl alcohol), for instance, allows higher compression than straight-run gasoline under ideal conditions. Of course, high compression ratios require sturdy, heavier, engine construction to withstand elevated cylinder pressures.

Although gasoline has compression ratio limits that are significantly lower than certain other fuels, its air/fuel ratio for chemically correct economical burning is about 15 parts of air to 1 part gasoline (15:1). Because lean air/fuel ratios are necessary for economical engine operation, gasoline is hard to beat. Compared to gasoline, methanol is about 9:1, and nitromethane is 4:1. On the negative side, gasoline engines run hotter than methanol-burning engines and are more likely to produce accidental fires.

Lower shaft speeds, smaller transfer and exhaust ports, a longer expansion (power) period and the reed-valve induction system all contribute to more efficient engine design. However, efficiency and power are mutually exclusive; economical engines aren't powerful engines.

If all this sounds like "back to the future," it is! Our earliest production engines from the 1930s were designed very similarly. Unfortunately, engineers couldn't use high compression ratios because metal alloys for pistons, lightweight castings and other critical construction components were inferior; they couldn't withstand the temperatures and pressures.

HOT RE-STARTS, ROD WEAR AND BEARING RUST

Bobby Green of Birdsboro, PA, has several concerns: "What causes the connecting rod on my Fox .40 ABC engine to wear when it's run very rich [4-cycling] for long periods? I thought the extra oil I use in the fuel would help, not cause harm."

Bobby, the worst thing you can do to an ABC-type engine—other than running it lean—is to run it 4-cycling rich for long periods. When new, most ABC (aluminum-alloy piston with chrome-plated brass cylinder) engines exhibit an interference fit (components that actually touch) as the piston crown passes top dead center (TDC) when turned over by hand. In many cases, you can actually hear the piston squeak; this is normal. Originally designed for fast, 2-cycle operation, the piston and cylinder expand similarly (slightly more for the cylinder), maintaining a good gas seal without enduring the mechanical drag of a piston ring. Unfortunately, when operated at a rich 4-cycle (engine firing once every other revolution), the piston and cylinder never reach design temperature and the piston rubs at TDC, causing great wearing loads (pounding) on the piston wristpin bosses and both connecting-rod holes. The piston fit also is worn away at its crown, further degrading the engine's mechanical condition. In the future, always try to run ABC-type engines (including the AAC and ABN types) in the 2-cycling mode, especially when they're new.

"What causes an engine not to start when it's hot? The Fox .40 starts fine when it's cold, but it won't even 'pop' when it's hot!"

When hot, most ABC-type engines are relatively difficult to start. The hot clearance between the piston and cylinder reduces compression to a point at which combustion chamber start-up conditions are questionable. This is magnified if the squeaky fit has been worn away because of cold, 4-cycle operation. You didn't mention whether you are attempting to hand-start or are using an electric starter. By richening the carburetor's high-speed needle valve a bit and using an electric starter, the hot ABC engine can often be coaxed into starting.

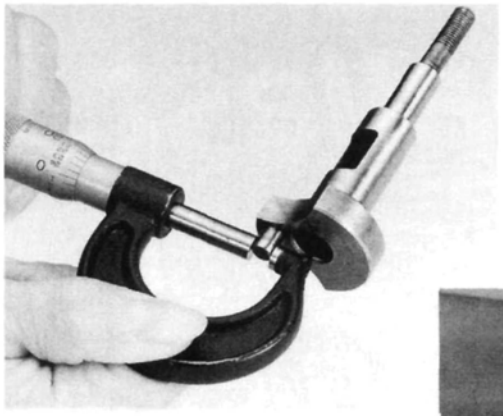
"I am having rust problems with the crankshaft ball bearings in all of my engines. Any suggestions?"

You aren't the only one with bearing rust problems, Bobby. A few suggestions:

- At the end of a running session (bench or flying), run the engine completely dry of fuel from a wide-open throttle setting (pinch the fuel line or run the tank dry).

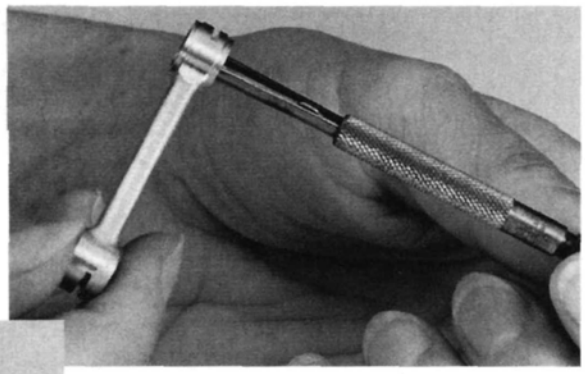
- Load the engine crankcase with after-run oil (I use Marvel Mystery Oil). For a .40-size engine, I squirt at least ½ ounce into the venturi while turning the propeller over slowly. Rotate the induction valve to the closed position so the oil won't run out.

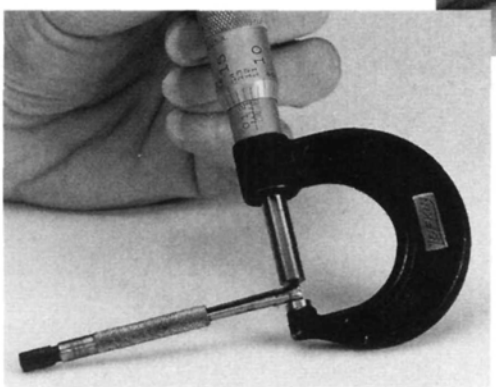
- When not in use, set the engine on its nose to ensure that oil floods the bearings. Place a rag under the nose because some of the oil will probably escape through the front crankshaft seal. Note: never use WD-40 on rusty bearings. My good friend Clarence Lee discovered that it breaks the rust loose, but then the rust runs through the engine the next time it's fired up, and iron oxide (rust) is very abrasive.



Measuring the crankpin diameter with a 0- to 1-inch outside micrometer.

Right: measuring the connecting-rod-hole diameter (crankpin end) with a small hole gauge.





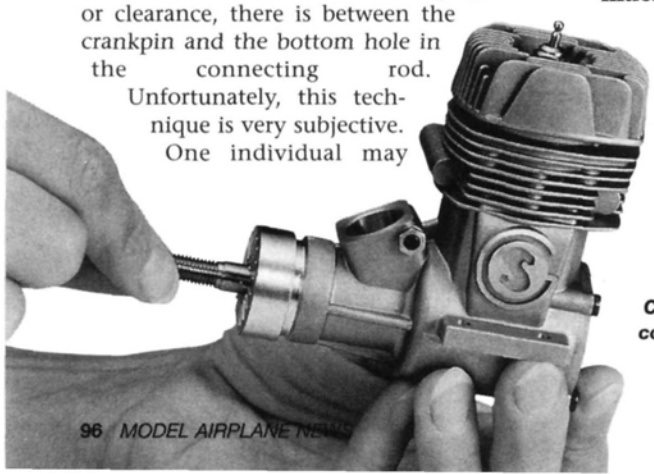
The actual size of the connecting-rod hole is being measured by the 0- to 1-inch outside micrometer, from the small hole gauge.

"How can I check for connecting-rod wear without disassembling the engine?"

It's difficult to check for connecting-rod wear without disassembling the engine. I've seen experts attempt to do it this way: with the glow plug and propeller in place, slowly turn the engine over until the piston is at TDC (with compression gases above it). Gently rock the crankshaft from side to side without allowing the piston to move. The relative movement on either side of TDC indicates how much play, or clearance, there is between the crankpin and the bottom hole in the connecting rod.

Unfortunately, this technique is very subjective. One individual may find the amount of play acceptable, while another will conclude that the rod is badly worn. Also, it's difficult to accurately tell whether a connecting rod is worn out by wiggling it back and forth after removing the engine's backplate. In my opinion, the engine must be disassembled to the point at which the rod can be removed from the crankpin. Before measuring, both components must be cleaned and dried. The crankpin can be measured with a 0- to 1-inch outside micrometer or a vernier caliper. With a small hole gauge (or vernier caliper), take a few measurements of the rod-hole diameter. Don't be surprised if it's oblong; this is how rod wear usually shows up.

Accumulated clearance data show that the range of acceptable tolerances for a connecting rod is between 0.0015 and 0.002 inch. If the crankpin end of the rod measures 0.0025 inch or more, it's considered to be too loose. Generally speaking, if the hole is more than 0.0005 inch oblong, there's a problem, and the connecting rod should be replaced.



Checking connecting-rod play?

ENGINE MODIFICATIONS

Carlos Adriano Marceddo of Coqueiros Floranopolis, Brazil, writes about engine modifications:

"I have an idea to improve the operation for two of my engines: the O.S. 40FP and the Thunder Tiger 40 GP. They each have cylinders where the transfer and boost ports are machined squarely through [90 degrees to the cylinder centerline] the cylinder wall. Can I file these ports at an upward angle to gain a smoother running, more powerful engine? Can you tell me some tricks for increasing power?"

Carlos, by angling the transfer and boost ports toward the head, you will change the transfer timing of the engine. As a result, these ports will remain open longer, as measured in terms of degrees of crankshaft rotation. By performing this modification, you will reduce the exhaust lead (the period between the exhaust opening and the transfer opening), which affects the blowdown event (exhausting prior to the transfer port opening). This increases the likelihood that fresh air/fuel mixture will be contaminated by exhaust gases, resulting in reduced engine power and efficiency.

Engine designers and engineers have spent considerable time and effort developing successful production engines for the modeling community. If there were helpful modifications, they would have been incorporated into the final product. Of course, certain changes can be made to improve power, but these are almost always compromises made at the expense of other attributes, such as reduced fuel efficiency, engine life and the possibility of catastrophic failure due to an overloaded component.

My suggestions for improved engine operation are:

- Read and follow all written instructions supplied by the engine manufacturer.

- Thoroughly break in your new engine according to accepted operational practice.

- Use fuel that contains adequate percentages of lubricant (as suggested by the engine manufacturer).

- Only use fuel from a manufacturer who clearly states the lubricant components and percentages on the label.

- Never adjust the high-speed needle valve for maximum rpm and fly with the engine that way. Always back off (rich) several hundred rpm because most engines lean out in the air.

- Run the engine dry of fuel at the end of the operating session and use generous quantities of after-run oil to prevent bearing rust.

If you desire improved engine power, investigate commercially available engines with a greater displacement (size).

If you have a question related to engines or their systems, send them to me in care of the "Real Performance Measurement" column at *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA, or better yet, email c/o *Model Airplane News*, man@airage.com.

NAME THAT PLANE

Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free, one-year extension of his subscription.

Congratulations to Joe Jablonski of Paoli, PA, for correctly naming our May 2000 mystery plane: the Fairey Swordfish. The Swordfish was designed to meet the Air Ministry's need for a carrier-based "torpedo-spotter-reconnaissance" aircraft. The 45½-foot Swordfish surpassed even the military's expectations, as the plane was an effective torpedo bomber; it was credited with sinking a wartime average of 50,000 tons of enemy ships per month! During its 10 years in full-time service, the Swordfish served as an anti-submarine weapon, nighttime flare dropper, trainer, mine layer and convoy defender. Even after the plane's production ceased in mid-1944, the military continued to use the Swordfish as an equipment testbed; the pictured airplane was demonstrating a rocket-assisted takeoff!

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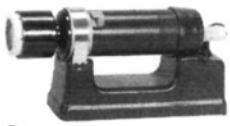

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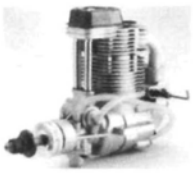

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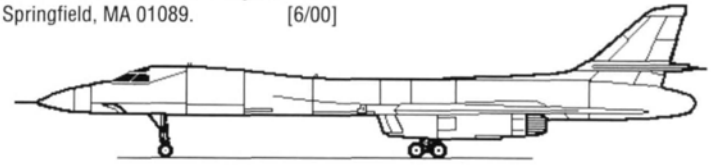

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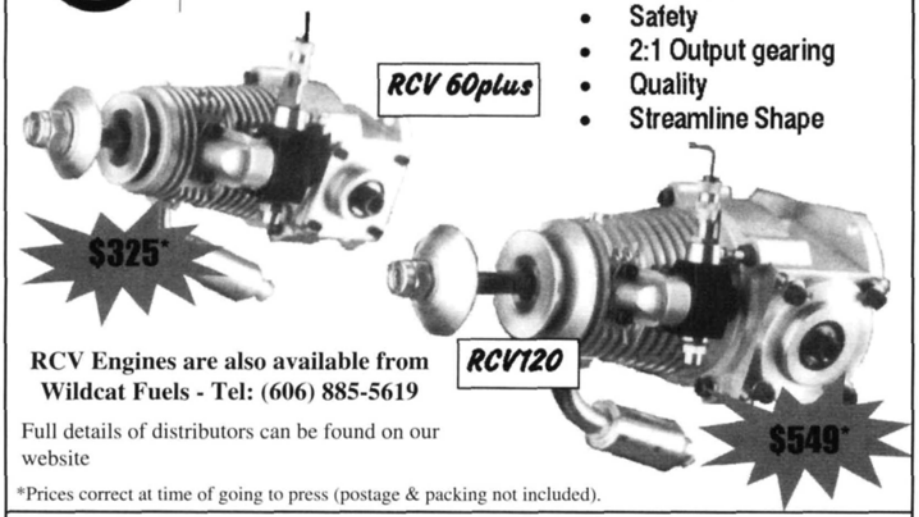

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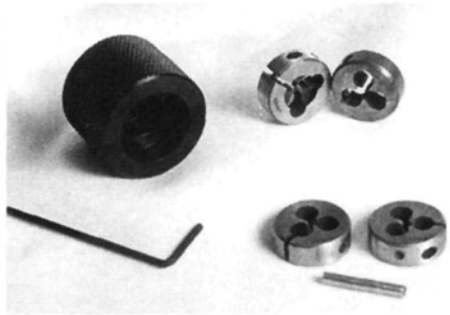

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BY GUY REVEL

A ⅓-ounce RC flyer

The lightest amateur-built, proportional RC plane ever flown during an indoor meet used to be called "2xRien," French for "twice nothing," but when its weight was further reduced, it was renamed "Moins que Rien" (less than nothing!). Flown at the Paris Model Show in April, the latest creation of the JMP team (Gerard Jumelin, Jean-Marie Piednoir and Jean-Yves Martin) is a 21.5-inch-span model that weighs only ⅓ ounce (8.9 grams!) and can fly for 2 minutes.

It's difficult to convey the excitement of seeing this very practical airplane with astonishingly nice flight characteristics in the air. With a wing loading of a mere 0.35 ounce per square foot, you bet it flies slowly! Part of the weight savings is owed to the use of a single Sanyo 50mAh battery that feeds both the radio and the motor, thanks to a special voltage converter designed and built by Jean-Yves Martin. (The steel case of the battery was stripped off and replaced with a sealed plastic bag—something I do not recommend that you do in your own workshop!) Because of the high current drain, the Sanyo Ni-Cd cell cannot be replaced with a lighter NiMH cell.

Just for the record, the team had considered using infrared control to save weight but decided to use a traditional FM radio link, which allowed 2xRien to fly with other models as well as at any indoor flight meet. In the quest to build the world's lightest RC model, Jean-Marie Piednoir designed a miniature, 4-channel receiver with a plug-in crystal that will soon be commercially available from WES-Technik. The new JMP receiver is definitely selective, as 2xRien has routinely flown with four or five other models in a small 40x40-foot hall without any sign of radio disturbance. For the latest, 8.9g Moins que Rien version, however, Jean-Marie stripped the receiver of many of its components. Although the bare receiver has poor selectivity and severely limited range, it weighs only 0.71 gram! The high-frequency ESC received the same treatment and now weighs only 0.3 gram.

The JMP team (left to right): Gerard Jumelin, Jean-Marie Piednoir and Jean-Yves Martin with the Wizard of Oz, a 1-ounce model, and their 2xRien ("next to nothing") model, which they renamed "Moins que Rien" ("less than nothing") when its weight was decreased to less than 10 grams.

SPECIFICATIONS

Model: Moins que Rien ("less than nothing")

Type: slow-fly monoplane

Construction: carbon fiber, Mylar covering

Wingspan: 21.25 in. (540mm)

Length: 16.54 in. (420mm)

Wing area: 127 sq. in. (8.2 sq. dm)

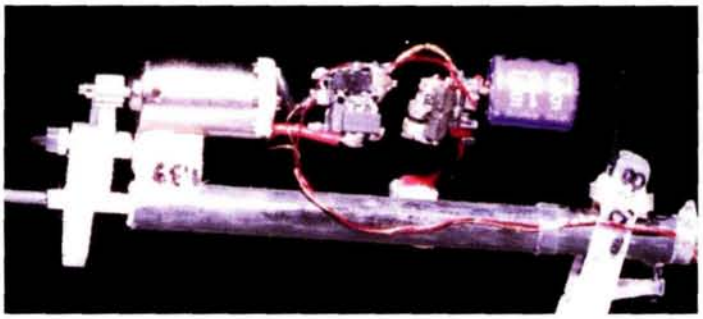
Weight: 0.31 oz. (8.9g)

Wing loading: 0.35 oz./sq. ft.

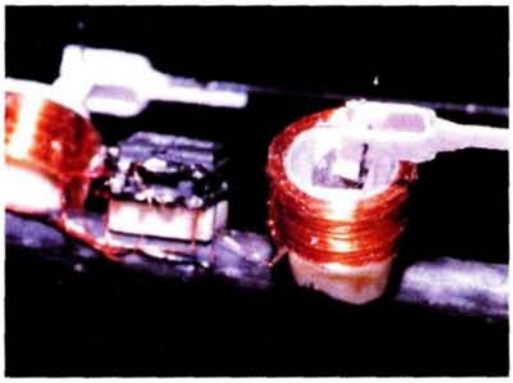
Drive system: coreless motor w/22.8:1 JYM gearbox, JMP 6.3x3.9 prop, JYM proportional magnetic actuators, JMP FM receiver and ESC, JYM voltage converter (0.6W, 0.9V to 11.4V in, regulated 5V out), one 50mAh Sanyo Ni-Cd cell.

Working at reducing weight, new ideas come every day. While Jean-Yves was flying the light model in front of thousands of spectators at the Paris Show, he quietly told me that the team has established a new challenge: they are already working on a sub-5g model!

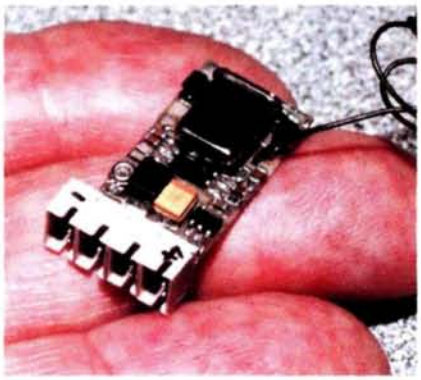
For more information and video clips of the JMP team's models in flight, go to: ourworld.compuserve.com/homepages/jmquetin/jmpmoine.htm. ✈



The 4mm-diameter cellular-phone-buzzer motor provides flight times of 2 minutes. The motor and reduction gear weigh 0.97 gram. To the right of the motor is the special, stripped-down JMP 5 ESC and DC/DC converter (1.2 to 5V) with its (relatively!) large capacitor.



These actuators are made by Jean-Yves Martin and are fully proportional; the controller is between them. The control arm is glued directly to the rare-earth magnet moving inside the coil. Copper wire is wound around a thin paper tube. Their position is proportional to the current flowing in the coil.



This is the 4-channel production version of the stripped-down ESC used on the model produced by WES-Technik in Germany and distributed in the U.S. through David Lewis. It uses a miniature interchangeable crystal.